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Vol. VII. NEW YORK, APRIL 17, 1886. No. 16.

WE publish to-day two more special articles dealing with electrical development on the Pacific Coast. They give a very good idea of the manner in which the various departments of the business have been built up by some of the ablest electrical men in the country. As regards the future, it is not unlikely that San Francisco will soon become an important electrical entrepôt as well for the Far East as for the Pacific Coast itself.

THE method of testing dynamos and motors devised by Dr. Hopkinson and described in another column is one which, while not adapted for universal application, possesses some advantages. The principal one of these is that the power to be measured is small, and the percentage of error is correspondingly reduced. In addition to this must be considered the fact that large powers are difficult to handle with transmission dynamometers, and more reliable results are obtainable with small powers. The method, however, requires two dynamos, one being used as a motor, and hence, as stated above, it is restricted in its application. Its simplicity is greatly in its favor, and when the precautions to be taken with its use have been fully shown it may occupy a prominent position as a method of dynamo and motor testing.

ACTING upon the hint given by certain incidents brought to light by the investigation of the Pan-Electric telephone scandal, a Baltimore manufacturing concern has copyrighted as trade-mark for a new saponaceous cleansing compound the words "Pan-Electric." It is understood that the company has sent a cake of the soap, with its compliments, to each of the statesmen interested, inviting them to try it.

THERE is little improvement to report in the telephonic situation in Indiana, but such as it is we should be thankful for it. One of the subscribers to the system in Indianapolis in a letter to the paper asserts that the whole opposition to the telephone company has a large element of personal spite in it, and he remarks: "None but mobs hang a man without giving him a reasonable time for preparation. Let us not play the mob by destroying a plant which was built with our consent and without any intimation that we would render it valueless by adverse legislation." It is true that in Indianapolis, the city council has revoked the street franchise for pole lines, but the people there as elsewhere in the State are very desirous to get telephonic service in some way. The company will meet them if it can do business with fair profit; not otherwise. It is worthy of note that the Legislatures of Ohio, New Jersey, Maryland and Massachusetts have all decided not to follow the Indiana example for the present.

WE have received reports of the first annual meeting of the Western Counties and South Wales Telephone Company, and of the opening of a new exchange by the company at Bournemouth, one of the most fashionable watering places in the south of England. It is evident from both documents that the telephonic prospect is brightening so far as the region named is concerned. The company is paying 6 per cent. dividends, and has important trunk and toll line work in contemplation, especially for the great Welsh coal fields. It is pleasant to read that at Bournemouth the telephone manager is regarded in the light of a "public benefactor." That is the capacity of any good telephone manager anywhere; but, to read some newspaper talk, one would imagine that in America the average manager is a diabolical, bloodsucking representative of a tyrannical and soulless monopoly. We would like to see some of the vituperative scribes operating an exchange for a few weeks. It is noted, by the way, that the subscription rate at Bournemouth is $50 a year, as compared with $60 at Brighton, $75 to $80 in Bristol and fifteen other towns, and $100 in London, Manchester, Liverpool and Glasgow. We think that American rates compare, for moderation, very favorably with these.

SO MANY inquiries have of late been addressed to us regarding the nature of the Pan-Electric apparatus in use, and so little is generally known on the subject, that we are glad to be able in this issue to meet the demand for information. Our article and the illustration accompanying, on the Pan-Electric telephone, are the first that have been published in any technical or other paper. It may be remarked that the present almost universal method of charging a fixed rental is not always and entirely an equitable arrangement. Under the prevalent system, a subscriber using his instrument a few times a day has to pay as much as one who uses it twenty or thirty times. Hence, when we take into consideration the fact that one of the largest items in the cost of running exchanges occurs in making connections, it becomes evident that some discrimination should be made between subscribers whose use of the service varies. The automatic device we illustrate looks like a good and feasible one, and it is said to work well. Very similar apparatus is in use at Bradford, England, and the charge per connection system has had other trial in this country with fair results. Perhaps if it were more widely adopted, optionally with the subscriber, grumbling might be checked.

MR. EDISON'S "Phonoplex," or "Way Duplex," which we describe in another column, is a most ingenious application of the varying action of the telephone when subjected to currents of different qualities. It is somewhat strange that the telephone has not been more generally introduced into railroad service, but this new adaptation of it is one step in the right direction. The entire independence of the operation of both kinds of signals from the condition of the line, evidently makes it possible to send and receive from any point without altering the condition of any of the office apparatus. The system is specially adapted to railroad work where a large number of offices are looped in on the same line, and where heretofore only one could be communicated with at a time. The application of the telephone to the purposes of a telegraph sounder, the loudness of which exceeds even that of the ordinary "giant" sounder, is destined to a wider application than would appear at first sight. Such sounders being very sensitive, and that only to the momentary high-potential currents sent over the line, might with equal propriety be substituted on the ordinary single lines instead of the relay and sounder. The battery required is practically the same for all distances, and is far less than is necessary with the Morse system. Altogether the invention is a very promising one, and while not entirely original in principle, it is nevertheless a new application of considerable originality, in a department where Mr. Edison has done some of his best work.

IT has been generally supposed that that monster monopoly, the Western Union, had intrenched itself in an impregnable position and that all competition was destined to be crushed. It is true that other companies have lately grown to some extent, yet not to such proportions as to be designated as rivals. But at last a true rival of the Western Union has come upon the scene, one before which indeed all others must give way, for competition, except at ruinous rates, is now out of the question. The system to be operated by the new company is nothing less than the air or induction telegraph, and the wires which will be used are none others than those of the existing companies. No one, surely, can prevent a man from covering his house with a tin roof and sending induced currents over the telegraph wires by charging his own roof. And no one can prevent an equally enterprising genius from receiving the messages in a similar way at the other end. The prospectus of the company, printed on heavy paper of the best quality—so says the report from Kansas City—shows conclusively that the scheme will be a brilliant financial success and, indeed, how could it be otherwise, with no items of construction, repairs, interest on plant, depreciation, etc. A Kansas City genius has already bought a number of shanties alongside the telegraph line. He will alter these into elegant offices, operating rooms and battery rooms, "banquet halls for the directors of the company and dormitories for intoxicated operators. In all the arrangements for beginning operations, evidence is given that the corporation will be public spirited and that its employés will receive some benefit from the profits." This is evidently the most dangerous new comer that has ever appeared in the telegraphic field, and it menaces not only the life of the Western Union, but of all its competitors as well. We are not informed as to the rates to be charged by this parasitical corporation, but they will no doubt be ridiculously low, let us say 25 words for 1 cent.

THERE can be no doubt that at the present time the majority of electricians are of the opinion that incandescent lighting from central stations can be successfully—*i. e.*, commercially—accomplished only by the use of a high-resistance filament requiring a correspondingly high potential. This, of course, allows of a reduction in the size of conductors—the principal item of cost in incandescent distribution on the *parallel circuit* system. A lamp of low resistance requiring a large current installed in such a circuit would be a commercial failure, it is admitted, and hence the low-resistance lamp, the first form, has been tabooed. But it is frequently the case that after experience has been obtained with newer forms, the older ones are rehabilitated and made to answer a useful purpose. Such reflections arise on reading the paper of Mr. Alexander Bernstein, given elsewhere in our columns, and of which he has kindly forwarded us the advance sheets. Briefly stated, Mr. Bernstein advocates the use of low-resistance incandescent lamps, working at a low potential and placed in *series*. Hundreds of such lamps can evidently be placed on a conductor no greater than that of an arc light wire at any point, and hence the cost of conductors would be reduced to a minimum. Mr. Bernstein brings good arguments forward in favor of this system of grouping incandescent lamps, one of the principal, besides the economy in conductors, being the greater life which he claims can be obtained with low-resistance lamps. His experiments upon incandescent lamps with smooth and with rough, sooty filaments are also interesting. So far as Mr. Bernstein's system is concerned, it has already been put in operation, both in this country and abroad, in a modified form. The Edison "municipal system" of street lighting is, as will be remembered, the placing of incandescent lamps in series and running them from a high potential dynamo. This has proved a success in various cities, such as Portland, Me., and we see no reason why it should not be adopted in regular central station work for indoor lighting, as Mr. Bernstein proposes. The Gaulard and Gibbs system of distribution is another form of the same system. To the timid the running a high potential circuit into our homes may seem a hazardous proceeding, but it certainly is not as dangerous as the present gas, the perils of which we all know and guard against. With the proposed system, good insulation within the building and freedom from grounds are all that are necessary to make an absolutely safe installation. With all this on the side of the low-resistance lamp, it seems probable that it may gain a sphere of usefulness, making it a rival to its younger brother, the high-resistance lamp. Certain it is that experience has already shown the practicability of the system, and electricians will not be slow to remedy any defects which may crop up, and to provide means for making it perfectly safe.

## How to Wind the Magnets for Shunt, Series and Compound Machines.—VI.

BY CARL HERING.

(*Continued.*)

COMPOUND MACHINES.

Let it be required to wind the machine compound, that is, with both series and shunt coils, so that the difference of potential at its poles shall remain constant, or nearly so, for any number of lamps.

The general principle of the compound winding is as follows: In a simple shunt machine, the greater the current in the external circuit or in the armature, the greater will be the fall of potential in the armature itself, due to its resistance, and therefore the less will be the potential at the terminals of the shunt coils. This decreases the current in them, thus diminishing the magnetism, which again decreases the potential. The potential at the poles of the shunt machine must, therefore, fall a certain definite amount with an increase of the number of lamps in circuit. The increased "counter-magnetism" of the armature, due to its own current, also tends to decrease the potential for an increased current.

If by some means these losses of potential due to an increased current could be replaced automatically by an exactly equal amount by increasing the magnetism proportionally, it is evident that the potential at the poles could be made to remain constant or nearly so. This may be done by adding series coils to such an amount that the total magnetism of the field increases with an increasing current in the external circuit, so that the potential at the poles of the machine is maintained constant. To show how to properly proportion the series and shunt coils so that the machine will give this constant potential at its poles, is the object of this article.

The connections of the shunt coils may be made in one of two ways. In the first of these, called the ordinary compound machine connection, and shown in Fig. 3, the terminals of the shunt coils are connected to the poles of the armature, or, what is the same thing, to the brushes. The current in the series coils is, therefore, not the total current of the armature, but is the current in the external circuit, or, what is the same thing, the armature current less the shunt current. When no lamps are burning, the series coils are idle, the shunt coils alone being used to keep the machine at its proper potential. If the potential at the poles of the machine is constant, it will not be so at the poles of the armature or at the brushes, and, therefore, not at the terminals of the shunt coils. The potential at the latter will be equal to that at the poles of the machine, increased by that which is absorbed in the series coils, which latter quantity is evidently the current in the external circuit multiplied by the resistance of the series coils, and is, therefore, a variable quantity depending on the number of lamps in circuit. The current in the shunt coils is, therefore, not a constant one, but depends to a small extent on the number of lamps burning.

The second system of connecting the coils is called by Prof. S. P. Thompson the "long shunt" method, and is shown in Fig. 4. The terminals of the shunt coils are not connected to the brushes as before, but to the poles of the machine. The potential at these points being constant, the current in the shunt coils is constant for all loads, and represents, therefore, a constant magnetization such as from steel magnets or from a separate exciting machine. The current in the series coils is in this system the whole current of the armature, because the current passes from the brushes directly into the series coils and afterward divides between that in the external circuit and that in the shunt. The series coils act to a certain extent both as series and shunt coils, for the current in the shunt coils flows through the series coils as well, and when the machine is on open circuit, the shunt current has to flow through the series coils first, thus making them act as shunt coils also.

It is a question which of these two systems is more economical as regards material, operation and construction, though it is probable that the second or "long shunt" method is the better. In regard to material, the second is probably cheaper, for although there is a trifle more lost space between the wires, owing to the thicker wire of the series coils, yet there is less space and material wasted in the insulation. For suppose we were to wind a thin shunt wire and a thick series wire together to take the place of the single series wire of the second method which carries both these currents, the two wires would evidently take up more room and would cost more in material than the one thick wire, although answering the same purpose. In regard to the economy of operation of the two systems there is probably very little difference. There may be a slight difference in favor of the "long shunt" method because the magnets will be slightly less bulky. In regard to economy of construction, there is less work required to wind the magnets the second case, as there are always less windings in all. If certain errors in the calculations which may often be neglected are corrected, the long shunt method becomes somewhat easier to calculate than the ordinary. In many cases, especially for large, well-proportioned machines, there will be very little practical difference between the two methods.

The test of the machine, preceding the calculations for the proper proportions of the series and shunt coils for either the ordinary or the long shunt method, is the same for both, and is made as follows, independently of the method of winding which will be used.

Make the test for determining the magnetism, with temporary coils and a separate exciting machine, in the same way as was described for shunt machines, only that instead of making but one test for full load, make a series of tests (as many as practicable—say fifteen to twenty) beginning with a little more than full load, and continuing by diminishing the number of lamps, down to an open circuit or no lamps. For each different number of lamps, adjust the exciting current until the potential is the required amount and then measure both the exciting current and that in the lamp circuit, being careful that the speed remains the same, for with a poorly governed engine the speed is likely to increase as the number of lights diminishes. The speed should be noted and *must not be changed*, as the proportioning of the coils is different for different speeds. The machine should be run for a time on full load or even more, so as to become warm throughout. In the absence of a reliable ampère-meter for such a large range as is required for the current in the external circuit, it is sufficiently accurate, if the lamps are uniform, to calculate the current in the external circuit from the number of lamps, by measuring accurately, once for all (and with the same instrument to be used for the exciting current) the current required by a

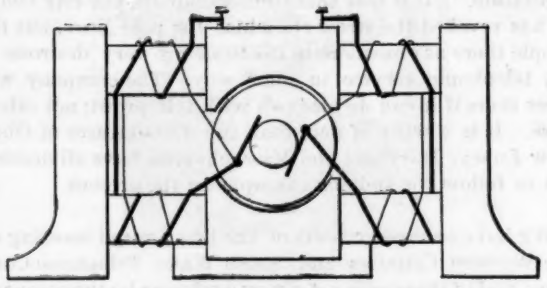


Fig. 3.—Ordinary Compound Winding.

large number of lamps *at their proper potential*, and dividing this by their number. This constant gives the current per lamp and can be used to calculate the currents for the decreasing number of lamps. In this case, even if the constant of the instrument is not quite correct, the relative values of the lamp current and the exciting current are correct, and the test will give values which will answer the purpose. It is important to adjust accurately for the proper potential in each case, otherwise the results will be very unsatisfactory.

Before making this series of measurements it is advisable to examine the shifting of the diameter of commutation. To do this, run the machine at full load at the proper potential and adjust the brushes to the non-sparking position, then disconnect all but a few of the lamps, and run it again at the proper potential by changing the exciting current, and find the non-sparking position of the brushes again. If the change of position is very great, it is not advisable to attempt to make the machine a self regulating compound machine, as it will be very unsatisfactory; in fact it will evidently not be automatic if the brushes require to be adjusted. If the change of position is great, there are some wrong proportions in the machine, at least, for a compound machine. Probably it is the fault of the armature, as it may have too many windings, or its iron may be too hard, or there may be too few commutator

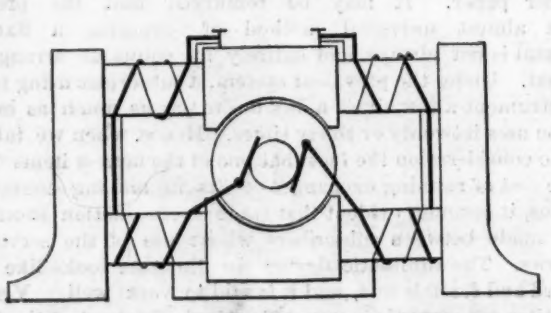


Fig. 4.—Compound Winding—Long Shunt.

strips, the self induction being too great. It may also be the fault of the pole pieces, as they may be too wide in the direction of rotation. Perhaps the field is unbalanced, having the iron unsymmetrically placed in the form of arms, bearings, base, etc. The brushes should not touch more than two, or at the most, three commutator strips at one time, and they should be precisely diametrically opposite each other. General hints, in regard to the best proportions, to prevent the shifting of brushes, will be given in the latter part of this article.

If the change of position of the brushes is more than about one-half inch, on a commutator of about four inches diameter, the machine is not well proportioned. A good compound machine ought not to spark or require the brushes to be moved, even for a sudden change from a full load to an open circuit or the reverse. They should only be moved when worn off. It is, of course, taken for granted that the contact surface of the brushes is more than the thickness of one insulation between the commutator strip, and that they are exactly diametrically opposite each other.

If the brushes need slight adjusting, it is best to find a mean position and keep them there for all loads, provided they do not spark too much to injure the machine for the extreme loads.

[TO BE CONTINUED.]

## On Telemicrophonic Apparatus.

BY M. E. MERCADIER.

I give the name telemicrophonic to mixed apparatus which produce simultaneously the effects of microphones and telephones, and which are reversible like the latter. Their construction, as regards transmission, rests on the following facts:

1. We may act upon a telephone or a microphone by the intervention of any thin *rigid* plate whatever and of a stratum of air, limited or not.

2. We may, without causing a magnetic diaphragm to lose its telephonic properties, load it with a weight up to a certain limit, which may even exceed the weight of the diaphragm. These two properties were indicated in the theory of the telephone which I gave in the *Comptes Rendus* (Vol. CI., pp, 744 and 1001).

3. The effects of a microphone placed in the primary circuit of an induction coil and of a telephone placed in the secondary circuit are superimposed when we act simultaneously upon both apparatus, either superimposing themselves or placing them in juxtaposition, or combining them intimately, the microphone being fixed to the membrane of the telephone.

As regards reception we may base it upon the following principle which I have indicated as regards radiophonic effects (*Comptes Rendus*, Vol. CI., p. 944), a principle already applied, but incompletely.

4. When the membrane of any telephone whatever separates two air-chambers, the one without and the other within the instrument, we may receive distinctly and strongly the movements of the membrane transmitted to the air by the aid of one or more acoustic tubes adapted laterally to these chambers, provided we give them suitable dimensions.

In accordance with these data, I have had constructed two types of telemicrophones which give good results, the one in which the telephonic and microphonic organs are superimposed, and the other in which they are combined.

We easily obtain an apparatus of this latter type by the aid of a D'Arsonval telephone, to the membrane of which are firmly fixed the carbons surrounded by a thin iron cylinder of a microphone of the system of D'Arsonval and P. Bert. These carbons are in the interior of the apparatus, a small auxiliary magnet regulating their pressure upon their support.

The membrane is surmounted by a lid forming an air chamber of at most 0.01 metre in height, perforated with a central aperture covered with any thin rigid plate (glass, mica, wood, etc.) against which we speak, and by two lateral apertures to which rubber tubes may be adjusted.

The electric communications are the same as in an ordinary microphone; the carbons are connected to the primary circuit of an induction circuit comprising the battery; the extremities of the coil of the telephone are connected to the outer circuit comprising the secondary wire of the bobbin.

As regards transmission, when we speak into the apparatus the iron membrane vibrates and produces simultaneously the following two main effects: 1, a microphonic effect in the primary circuit of the bobbin, consequently movements of the carbons fixed to the membrane whence result ordinary induced currents in the outer circuit; 2, a telephonic effect in consequence of the movements of the membrane in the field of the magnet whence result in the same outer circuit other induced currents which are superimposed on the former.

Although the weight of the carbons is greater than that of the diaphragm and is irregularly distributed over its surface, the apparatus acts very well as a telephone if we suppress the microphonic effect, *e. g.*, by opening the circuit of the battery; if, therefore, this suppression is produced accidentally, the transmission may continue without difficulty.

As for the reception, the apparatus is reversible, since it contains all the elements of a telephone. To use it as a receiver, it is sufficient to raise it to the ear. If we wish to leave it on a fixed support, we make use of acoustic tubes adapted either to the lid or to the chamber formed in the interior of the instrument. Care must be taken, as mentioned above, to have suitable dimensions, so as to avoid the effects of resonance, which give a sort of blur to articulate speech.

In determining these dimensions we may, without notably reducing the effects, adapt several acoustic tubes of small diameter (about 0.01 metre in diameter) to each of the air chambers of the apparatus. This enables several persons to receive at once the sounds or the words transmitted. We obtain thus a telemicrophone with multiple hearing tubes.

It will be seen, moreover, that this arrangement is applicable to ordinary telephones. I have thus, in fact, constructed telephones with 2, 4 and even 8 lateral hearing tubes, giving results capable of interesting applications.

The chief advantages of telemicrophones over ordinary microphones are the possibility of a double mode of transmission with the same apparatus; the reversibility of the transmitter which much simplifies reception; the re

duction of the number of organs of microphonic stations, and consequently the decrease of the total resistance of the apparatus on one and the same line. This reduction permits us to simplify the construction of the apparatus and to diminish considerably their volume.

### Trying to Tax Bell Telephone Stock.

The committee on taxation of the Massachusetts Legislature heard Senator Lilley, last week, upon his new bill, based upon the petition of S. H. Weaver and others, for a tax upon the market value of the capital stock of the American Bell Telephone Company. Senator Lilley argued that under this bill the State would receive from $150,000 to $200,000 revenue instead of $25,000. Messrs. George A. Bruce and Robert M. Morse, Jr., appeared in opposition

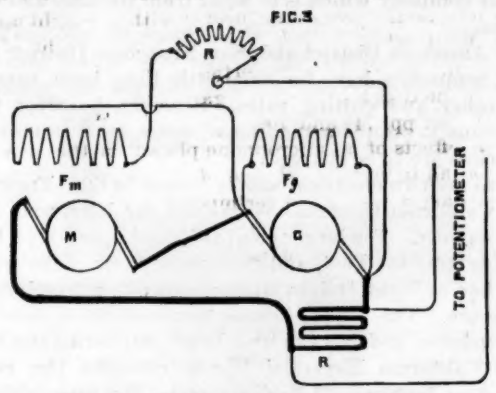



FIG. 2.—DIAGRAM OF CONNECTIONS.

for the telephone company, and Tax Commissioner Endicott said he was opposed to the principle of the bill. The full text of the bill follows:

Section 1. Section 2 of chapter 117 of the acts of the year 1880, as amended by chapter 200 of the acts of the year 1883, is hereby further amended by striking out all of the section after the word "lines," and inserting in place thereof the following, to wit: Said corporation shall be subject to the provisions of sections 38 to 41, inclusive, of chapter 13 of the public statutes, except so far as they relate to railroads or telegraph companies. Said corporation may, between the first and tenth days of May in each year, make a return to the tax commissioner, specifying therein the amount of all taxes assessed upon it exclusively in other States for the year in which such return is made; or if that is impracticable, for the year next preceding that in which said return is made, which return shall be made by its president, clerk and treasurer, and by them sworn to; and it shall be the duty of said tax commissioner, or his deputy, to examine the books, accounts and papers of said corporation so far as may be necessary for the verification of said returns. And said account, so returned and verified, shall be deducted from the amount of the taxes assessed upon the valuation of the corporate franchise, which shall be determined by the tax commissioner in the manner provided by section 39 of chapter 13 of the public statutes, in addition to the deductions provided for in section 40 of said chapter 13, so far as the same are applicable to said corporation.

Sec. 2. This act shall ake effect upon its passage.

### Dynamo Testing.

During the discussion of the paper on "Dynamo-Electric Machines," recently read by Mr. Kapp, before the Institution of Civil Engineers, Dr. John Hopkinson suggested an entirely new method by which the efficiency of conversion can be determined with great ease, and which he claims is not open to the objections raised against the accuracy of dynamometer indications when large powers are measured. The method also throws light upon other points of great interest, and especially on the much-discussed question as to the relation between the dynamo when used as a generator and motor respectively.

"Let two dynamos, approximately equal in dimensions and power, have their shafts coupled by a suitable coupling, which may serve also as a driving pulley; and let the electrical connections between the dynamos be made so that the one drives the other as a motor. If the combination be driven by a belt passing over the coupling pulley, the power required to be transmitted by the belt is the waste in the two dynamos and the connections between them. Moreover, by suitably varying the magnetic field of one of the dynamos, the power passing internally between the two machines can be adjusted as desired. If, then, the electrical power given out by the generator is measured, and also the power transmitted by the belt, the efficiency of the combination can be at once determined. The beauty and advantage of the arrangement lies in the fact that the measurement, which presents experimental difficulties, is of a small quantity, viz., the power transmitted by the belt. Consequently, even a considerable error in the determination has but a small effect on the ultimate result. On the other hand, the measurement of the large quantity involved, viz., the electrical power passing between the two machines, can without difficulty be made with great accuracy. Assume, for example, that the generator dynamo gives 50 horse-power, and the motor provides 40 horse-power of this amount; then the driving belt has to supply 10 horse-power only, and an error of 3 per cent. in the measurement of this quantity would cause an error of only 0.6 per cent. in the final result. The method thus obviates entirely the objections to other methods formerly employed, and has at the same time the advantage that the actual mechanical power transmitted to the machines is small, and therefore more readily dealt with by the dynamometer. In fact, an error of ¼ per cent. may be considered as the extreme limit, if ordinary precautions are taken.

"The two machines experimented on, shown in Fig. 1, were of the well-known Edison-Hopkinson type, with all the latest improvements introduced by Dr. John Hopkinson and Messrs. Mather and Platt. They are similar in all their dimensions and winding, and are each intended for a normal output of 110 volts, 320 ampères, at a speed of 780 revolutions per minute. They are both shunt-wound only, and have solid wrought-iron magnet cores and field pieces. The commutators are of copper, insulated with mica, with

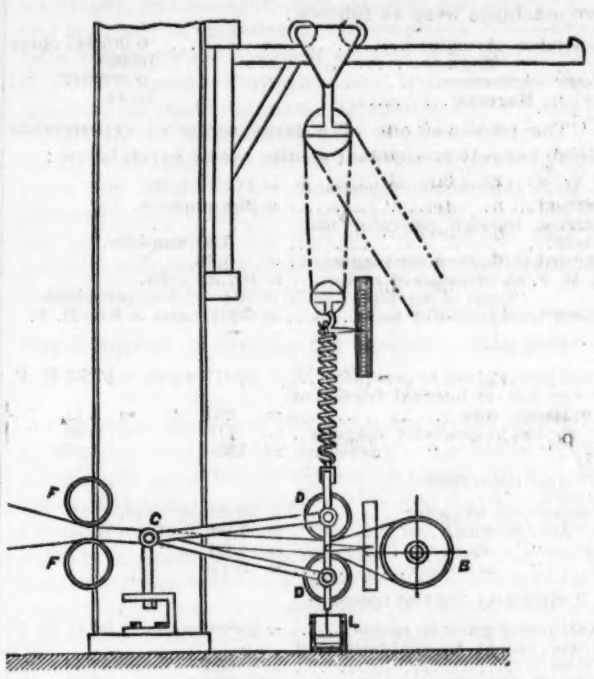



FIG. 3.—DYNAMOMETER ARRANGEMENTS.

40 bars. The general arrangement of the dynamometer is shown in the diagram Fig. 3.

"*B* is the driven coupling of the dynamos; *D D* are the guide pulleys of the dynamometer turning about the fulcrum *C*, and supported by a spring, the tension of which is read by a pointer against a fixed scale, when the index of the dynamometer is brought to its fiducial mark. The potential between the terminals of the generator was measured by a Thomson's graded galvanometer, previously carefully standardized by a Clark's cell, and the current was measured by passing it through a known resistance; the difference of potential between the ends of the resistance was determined by Poggendorff's method by direct comparison with the Clark's standard cell.

"The machines were electrically connected as shown in the diagram, Fig. 2, where *G* is the armature of the generator, *M* that of the motor, *F* the field magnets of the generator, and $F_1$ those of the motor, both fields being supplied with current from the brushes of the generator.

"It will be seen that if the exciting current were alike in both cases, the counter electromotive force created in *M* would be equal to the electromotive force created in *G*, and no current would pass from one armature to the other. To allow a current to flow it is necessary to slightly lower the counter electromotive force of *M*, and this is done by reducing the exciting current in $F_1$. In order to regulate the exciting power of the motor field magnets, a rheostat *r* is inserted into the circuit. The main current is measured by observing, on a potentiometer *P*, placed in a dis-

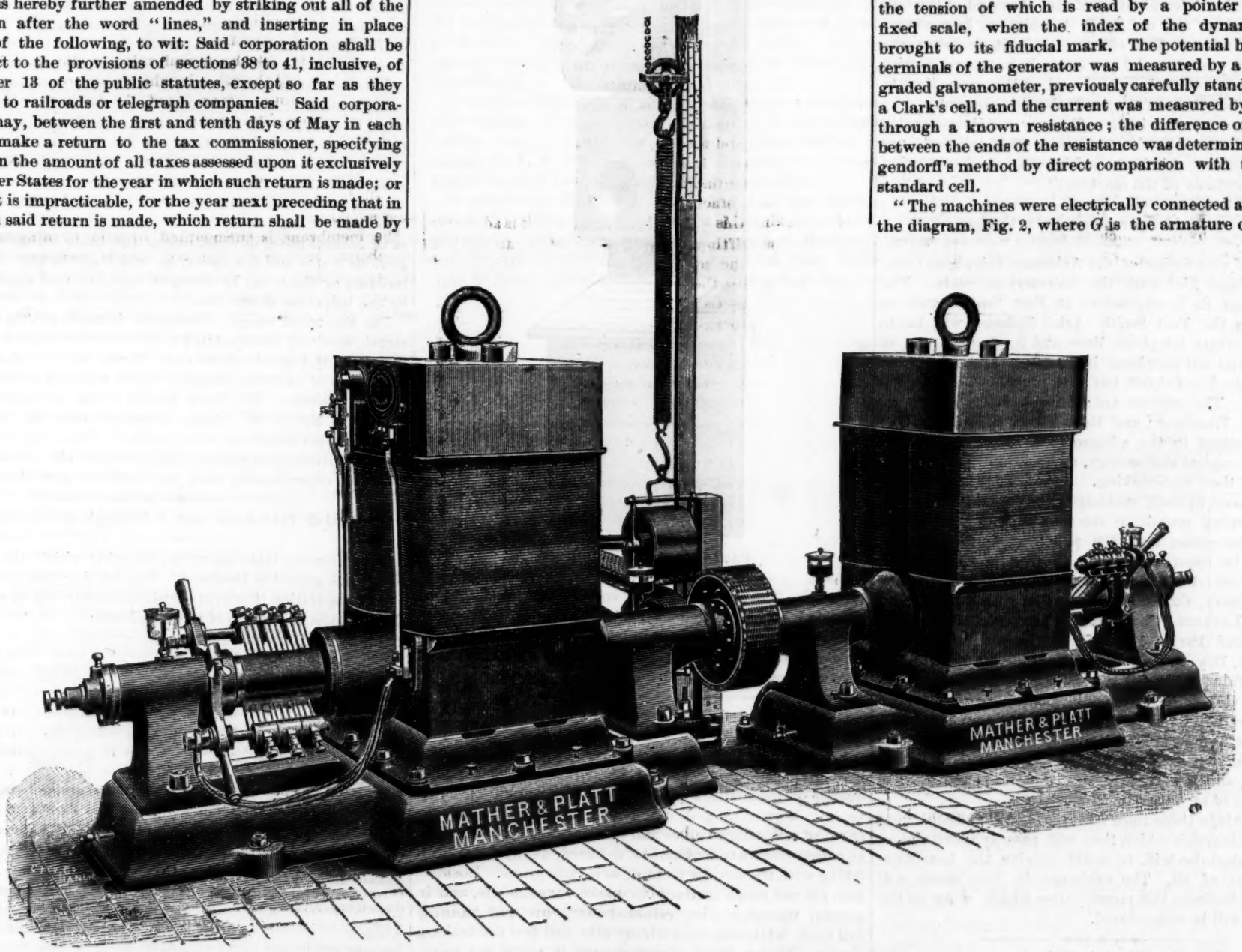



FIG. 1.—THE HOPKINSON METHOD OF DYNAMO TESTING.

tant room, the difference of potential existing between the terminals of a platinoid resistance *R*. This resistance was so low—.0058 ohms—that the strongest current which was used during the range of experiments did not sensibly heat it.

"The resistance of the armatures and magnets of the two machines were as follows:

| | | |
|---|---|---|
| Generator—Armature | 0.009947 | ohms |
| Magnets | 16.93 | " |
| Motor—Armature | 0.009947 | " |
| Magnets | 16.44 | " |

"The results of one of a large series of experiments giving entirely concordant results are as given below:

| | | |
|---|---|---|
| E. M. F. at terminals of generator | = 110.12 | volts. |
| Current | = 358 | ampères. |
| Current through generator magnets | = 6.50 | ampères. |
| Current through motor magnets | = 5.36 | " |
| E. M. F. at terminals of motor | = 107.33 | volts. |
| Speed of machines | = 764 | revs. per minute. |
| Power transmitted by belt | = 6604 | watts = 8.85 H. P. |

"Hence—

| | | | | |
|---|---|---|---|---|
| Total power given to generator | = 42917 | watts | = 57·53 | H. P. |
| Power lost in internal friction of armature core | = 831 | " | = 1.11 | " |
| Power lost in generator magnets | = 716 | " | = 0.96 | " |
| " " armature | = 1360 | " | = 1.823 | " |

"And therefore—

| | | |
|---|---|---|
| Commercial efficiency | = 93.23 | per cent. |
| Loss in core | = 1.94 | " |
| " magnets | = 1.66 | " |
| " armature | = 3.17 | " |

"Similarly for the motor—

| | | | | |
|---|---|---|---|---|
| Total power given to motor | = 38886 | watts | = 52.13 | H. P. |
| Power lost in internal friction of core | = 831 | " | = 1.11 | " |
| Power lost in motor magnets | = 472 | " | = 0.63 | " |
| " " armature | = 1275 | " | = 1.70 | " |

"And therefore—

| | | |
|---|---|---|
| Commercial efficiency of motor | = 93.37 | per cent. |
| Loss in core | = 2.14 | " |
| " magnets | = 1.22 | " |
| " armature | = 3.27 | " |

"In the above experiments, it is worthy of note that Lord Rayleigh's determination of the ohm and of the volt have been taken, and not the B. A. units, as in most previous experiments. The effect of this is to lower the efficiency between 1 and 2 per cent. in comparison with tests made on other dynamos, and at the same time to increase the accuracy of the results by this amount.

"These figures, showing an efficiency for the generator of 93.23 per cent., and for the motor 93.37 per cent., are very remarkable and indicate a high degree of perfection in the proportions of the machine."

## Telephonic Operations in Arkansas.

Articles of association of the Arkansas Telephone Company have been filed with the Secretary of State. The company has its headquarters at Fort Smith, and its object, says the Fort Smith (Ark.) *Tribune*, will be to build and operate telephone lines and exchanges, and to make, use and sell telephone instruments and apparatus. Its capital stock is $15,000, but will probably he increased to $30,000. The officers are: Simeon Baer, President: Jno. Vaile, Treasurer; and Geo. Tilles, Secretary. The parties interested in the advancement of the enterprise have ample capital and energy, and will, no doubt, make a success of their undertaking.

It is proposed to build exchanges in Fort Smith and Van Buren, charging rentals at the rate of $40 per year for business connection and $30 per year for residences. Lines will be constructed from Fort Smith connecting with all lines tributary to it. Line No. 1 will connect Alma, Mulberry, Ozark and Webb City; Line No. 2, Central City, Lavacca, Charleston, Chismville, Booneville, Magazine and Paris; Line No. 3, Greenwood, Hackett City, Salem, Dayton and Waldron; Line No. 4, Saliceau, Webber's Falls, Fort Gibson, Muscogee and Talequah; Line No. 5, Cedarville, Evansville, Boonsboro and Fayetteville. There will be a line of four wires connecting the Fort Smith and Van Buren exchanges. All the latest improvements for long or short distance telephoning will be adopted, and the construction and management will be in charge of an experienced electrician.

The advantage these lines will prove to Fort Smith and the towns through which they will pass is incalculable, and the enterprise will, no doubt, receive the hearty encouragement of all. The exchange in Fort Smith will be open for business this month, after which work on the other lines will be commenced.

## The Pan-Electric Telephone.

For some time past the Missouri Pan-Electric Telephone Company, at St. Louis, has been operating its telephone system on a novel plan, and which, judging from its success, seems destined to a wide application—should the Bell patent be annulled. The method adopted is, in effect, a simple toll system in place of a fixed charge per month; but the "subscriber," if he may be so called in this case, pays immediately for each service by depositing the charge in a receptacle specially provided for that purpose.

The telephone complete is shown in our engraving, and is the invention of Messrs. Rose and Rein, electricians of St. Louis. The toll device is all placed above the transmitter. When telephonic connection is desired, a nickel 5-cent piece is pushed into the slot in the upper box, and the ear phone is taken down. This removal of the telephone automatically sends in the calling signal to the central, and hence no "ringing up" is required. At the close of the communication the replacing of the ear-phone causes the nickel to drop into the cash-box attached below; at the same time the clearing out signal is sent in automatically.

Until the ear-phone is replaced, the nickel is held in suspension, and is under control of the central operator to this extent, viz., if the number called for is engaged, the central operator causes the coin to slide out upon the inclined tray to the left of the push-button, provided the push button be pressed at the same time.

In this way the subscriber pays only for the service he gets, a most equitable arrangement. Thus as soon as the telephone operator tells the subscriber that he cannot give him the desired connection, the latter presses the push button and his money is returned to him. This principle of justice commends itself to all and is said to arouse a very natural enthusiasm.

Ample provision is made to counteract any attempted dishonesty on the part of users. Thus, the slot for the coin is just large enough to admit the ordinary 5 cent nickel piece; the two-cent copper piece is too large; the cent, the 3-cent, the silver half dime, and dime coins, are too small and light. They slip through into the cash box without effecting connection. All the tricks that might be used to evade the inevitable nickel have been guarded against, so that the system is not merely novel, but commercially

PAN-ELECTRIC TELEPHONE.

valuable. The apparatus is not complicated as might be expected, and is not liable to get out of order. There are now over 200 of these automatic toll-collecting telephones in operation in St. Louis, and we are informed that they give universal satisfaction.

## Electrical Interests in California.

For two or three years California has been passing through a period of commercial depression, as a consequence of the rather reckless speculation which had previously been indulged in. This has naturally had the effect of unsettling values and discouraging for the time any improvements that can be deferred, as well as interfering with the development of new enterprises. Business men are not much inclined to make investments, and in general manufacturing establishments are not running full time, while some are wholly idle, and few are making money. Under these circumstances, it could not be expected that the electrical industries would be as flourishing as if general business were brisk.

The progress of electric lighting on the coast has been considerably retarded by reason of the dull times. Probably this branch has suffered more than any other. The California Electric Light Company, which does so much of the business, has not as yet proved profitable to its stockholders. On the contrary, several assessments have been levied. The company, however, now has a very fine plant, and its future is promising; but its experience in the past makes capitalists hesitate about investing their money in the business.

The telephone business has been affected somewhat—that is to say, it has not increased as it would otherwise have done. The system of charging a smaller rental—$5 a month in San Francisco—and in addition 5 cents for each connection, has unquestionably been more profitable for the company than would the one so generally followed elsewhere of a fixed rate irrespective of the amount of service required. The Californians have always been used to the switch charge, and prefer that system. There is probably more money made in the telephone business on the Pacific Coast, considering the amount of capital invested, than in any other branch of electricity

Telegraphy is in the hands of the Western Union, and the rates are proportionately higher than in the East. At the same time, there is an excuse for this in the comparatively smaller volume of business, owing to the country being so sparsely settled. It is said that Mr. Gamble is negotiating to establish an opposition company to build lines as far east as Omaha, there to connect with lines of another company which is to build from the east as far as Omaha.

The American District and San Francisco District telegraph companies have for some little time been running each other and cutting rates. Recently, however, they have come to an understanding whereby more remunerative prices are to be charged.

There are two electrical supply houses in San Francisco—the California Electrical Works and the Electrical Supply Company. The larger companies order many of their supplies from the East, and even more so since the war of rates has brought freight charges down to a merely nominal figure. The supply houses, however, do a considerable business, and carry quite a large and varied stock.

The California Electrical Works occupies the entire three-story building, 35 Market street. It was established by Mr. George S. Ladd, in 1868, under the title of the Electrical Construction and Maintenance Company, but subsequently it absorbed two or three smaller electrical companies and was reorganized under its present name. It was incorporated in 1870. Mr. Stephen D. Field was connected with it from the beginning until 1878. Mr. M. Greenwood, formerly superintendent of the Fire Alarm, is now the president; Mr. Paul Seiler, well known among manufacturing electricians, is superintendent, and Mr. J. G. Bloomer, formerly manager of the Western Union, is secretary and treasurer. The company issues a very creditable catalogue of 108 pages; which shows that it manufactures or keeps for sale everything in the electrical line, from an electric see-saw to a dynamo, and from a telegraph instrument to a telephone exchange outfit. Medical batteries and fire-alarm apparatus are made specialties. The automatic fire-alarm repeater of 20 circuits in the San Francisco Fire Department was made here, being designed by Mr. Seiler, who is also the inventor of several novel devices, one of the latest being an ingenious water and gas meter, by which all the meters in a building or block can be brought together and examined by the inspector at one time.

The Electrical Supply Company, located at 328 Bush street, was only incorporated in the fall of 1882, and it did not actually begin business until April, 1884. It deals in all classes of electrical supplies and is vigorous in pushing out for business. Mr. Orion Brooks is the president and manager, Mr. G. W. Pease, secretary, and Mr. Robert Langer, superintendent, of the factory. The company pays especial attention to medical batteries and also does considerable experimental work for inventors and others.

## Danish Telephone and Telegraph Statistics.

The following table shows the extent to which the telephone has gained in Denmark. Considering the percentage of population it proves that little country to be one of the foremost in the use of the telephone:

| TOWNS. | Inhabitants. | | Telephone subscribers. | Annual charge. |
|---|---|---|---|---|
| | No. | | No. | $ |
| Copenhagen | 315,000 | connected | 1,200 23 public stations. | 42.00 |
| Elsinore | 9,000 | connected | 43 | 42.00 |
| Kjöge* | 3,500 | | 30 | 28.00 |
| Nestred* | 5,000 | | 20 | 10.00 |
| Kallundborg | 3,500 | | 40 | 28.00 |
| Stage om Moen | 3,000 | | 30 | 14.00 |
| Nypjobing on Fubstor | 5,000 | | 40 | 28.00 |
| Nakkov on Laaland | 6,000 | | 65 | 28.00 |
| Odama | 22,000 | connected | 201 | 28.00 |
| Svendborg | 8,000 | connected | 80 | 28.00 |
| Nyborg | 5,500 | connected | 17 | 28.00 |
| Assem | 3,500 | connected | 51 | 10.00 |
| Faaborg and Ringe | 3,500 | connected | 25 | 28.00 |
| Middelfort | 3,000 | connected | 37 | 20.00 |
| Frederikshaven | 3,000 | | 35 | 14.00 |
| Aalborg | 15,000 | | 200 | 19.00 |
| Randers | 14,000 | | 50 | 19.00 |
| Aarhus | 25,000 | | 100 | 21.00 |
| Horsans | 13,000 | | 150 | 14.00 |
| Veile | 7,500 | | 67 | 19.00 |
| Kolding | 8,500 | | 130 | 14.00 |
| Esbjorg | 1,000 | | 43 | 11.00 |
| 22 towns | 482,500 | | 2,677 | ..... |

* These are being connected, but connection not completed.
These telephones have all been established by local companies and most of them pay a dividend.

The state telegraphs of Denmark comprise 1270 English miles of land and sea lines (6200 miles of wire) and 343

stations (7 in Copenhagen). The Copenhagen Town Telegraph Company has 14 stations in Copenhagen, and direct connection with the State Telegraph and Telephone Company's stations. Charge for a town message of ten words, 15 oere (4 cents) and 1 oere (¼ cent) for each word above ten. The Store Nordiske Telegraph Elskab (Great Northern Telegraph Company), established in 1868 by Mr. Tietgen, of Copenhagen (capital $7,500,000) has seventeen sea cables of the aggregate length of 6053 nautical miles in Europe and Asia and three stations in England, two in France, one in Sweden, three in Russia, one in Siberia, and four in China and Japan. The company possesses two steamers of 1580 tons each, for laying and repairing cables, and the company's officers (all Danes) are constructing and managing extensive systems of Chinese state telegraphs.

### The Edison "Phonoplex" or "Way-Duplex."

While the duplexing of through telegraph lines is now an easy matter and largely applied, the problem of increasing the capacity of lines employed in way service,

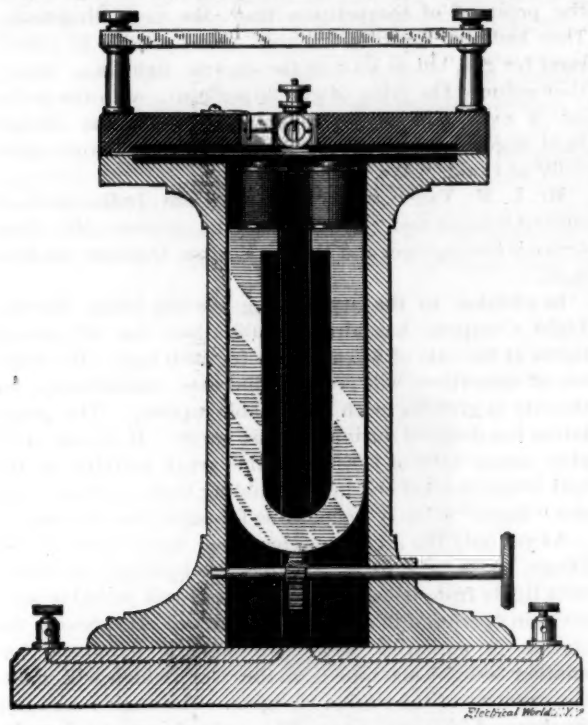



FIG. 2.—THE EDISON "PHONOPLEX"—THE "PHONE."

such as upon railroads, has up to the present received no satisfactory solution. The ordinary duplex requires a fixed condition of the line, and when that varies even slightly it must be compensated for. Evidently, with twenty or thirty stations on a railroad line, or ordinary way offices, the communication with each office on the usual duplex plan would require a separate balancing for each one, and as one office is called up after another there would be a constant changing and loss of time. Besides, the ordinary duplex would not permit of two independent offices communicating with one or two other offices, and hence its value would be greatly restricted; indeed, its successful application would be well nigh impossible.

With these drawbacks in mind, Mr. Edison has devised a most ingenious method of doubling the capacity of telegraph lines, whether employed on way business or through traffic.

The name which he has given to the system, the "Phonoplex," or "Way-Duplex," suggests immediately an application of the telephone, and such is indeed the case.

While Mr. Edison's method of working is analogous to that of Van Rysselberghe in his system of simultaneous telegraphy and telephony over the same wire, he, nevertheless, has an entirely different object in view, and that is, to convert the telephone on the circuit into a sounder, so that the regular Morse can be read from it.

Before entering into a description of the details, it may be well to give a short outline of the principle employed.

It is well known that if the emission and extinction of the current in the telephone be gradual, the diaphragm will be merely bent, and will return to its original form without emitting a sound. But if the make and break in the current be rapid, the telephone diaphragm will "snap," and so give forth audible sound. If now there are included in the same circuit a telegraph relay and a telephone, we may, by manipulating a key, operate the relay (and sounder) without producing a sound in the telephone, as the makes and breaks at the key are too gradual. But if through the same circuit we send the rapid discharge current from the secondary of an induction coil, or the extra current from a primary, it will cause a loud click in the telephone, but the current is too weak to affect the telegraph relay. Hence, by sending two kinds of currents over the wire, we obtain two effects which can be readily utilized for the purpose above described.

There are of course several points which must be observed in practice, and these have been well worked out, as will be seen in the diagram Fig. 1, which represents the equipment and arrangement of circuits in each office. The whole may for convenience be divided into the Morse and the "Phone" branch, although in reality there is no branch, as in the ordinary duplex—the line being continuous through both.

The Morse circuit at the left consists of the ordinary relay *R*, sounder *S*, and key *K*. In addition, however, there is a condenser *C*, placed as a shunt around the relay and key, the function of which will appear presently.

The "phone" circuit shown at the right contains the phone-sounder, with permanent magnet *M*, diaphragm *D*, and will be described more in detail below. The phone local battery *P L B* is in circuit with the primary coil *I*, which is always included in the line circuit, and also has a condenser *C'* connected to its terminals. The circuit coming from one terminal of the coil *I* is split, one branch going directly to the back stop of the relay *R'*, and the other to the front stop, but including a variable resistance *R''*. The phone operator manipulates the key *K'*, as usual.

For the sake of clearness, we will suppose that the Morse circuit is not at work. The circuit would then be from line through the phone, thence through coil *I*, through key *K*, relay *R*, battery and earth. But in addition the current has a by-pass through the condenser *C*. Now, when the phone operator closes his key *K'*, the lever of the relay *R'* breaks the circuit of the primary coil *I*, and the intense extra current of short duration is sent over the line. The effect of the extra current and the rapidity of discharge is still further increased by the condenser *C'* which is placed there for that object. This intense and rapid extra current does not affect the relays on the line, but passing through the condenser *C*, acts powerfully on the diaphragms of the phones and gives a violent motion to the snapper *P*.

It will be noticed that every movement of the lever of the relay *R'* sends two impulses over the line—one on breaking the circuit and another on making at the front stop. The extra current produced by the latter, however, is greatly diminished by the resistance *R''*, and follows so quickly upon the first that there is but one click heard in the phone. When the armature lever of the relay *R'* is released by the raising of *K'*, the reverse operation takes place, for we then have first a weak extra current over the line followed by a stronger one. This change in the order of the currents causes a difference in the sound emitted by the phone, just as in the ordinary sounder the sound of the front stroke differs from that of the back stroke. In this way the signals received in the phone can be clearly distinguished.

Thus far we have supposed that the Morse operator is not working. From what has gone before, however, it is evident that it makes no difference whether his key is closed or not, as the condenser *C* is all sufficient for the transmission of the high potential phone current.

In addition to the gradual emission of the Morse current which the operator's key produces, there is also added thereto the retarding influences of the relays in circuit and the primary coils *I*, which then have the same functions as when applied to the Van Rysselberghe system, in which they act as "graduators." While offering no reduction in speed to the Morse working, they "graduate" the emission of Morse currents so that they merely deflect the diaphragms of the "phones" without snapping them and producing a sound.

Though a variable resistance *R''* is used, it is merely for the purpose of varying the sound in the "phone" to suit the operator's ear, and once set is never disturbed.

The "phone" itself is a simple and ingenious apparatus, and is shown in section in Fig. 2. Resting upon a wooden base is a hollow column of brass, within which is placed a magnet with the bobbins facing the diaphragm. At the lower end of the magnet there is a rack and pinion, by which it can be adjusted with reference to the diaphragm. To the centre of the latter there is attached a screw-threaded pin, with thumb-nut and binder at the top. Encircling the pin loosely is a split-hardened steel ring which rests upon the diaphragm. When the latter is snapped by the attraction of the momentary current in the magnet, it throws the ring violently against the stop-nuts, and produces a sharp click, far louder than that from the ordinary sounder. The steel ring has a pin projecting from its side that passes between two prongs, which, while permitting free up and down motion, prevent the ring from turning and altering the sound. Over the top of the "phone" there is clamped a thin brass plate as a protection for the projecting screw.

This phonoplex system is especially valuable for railway telegraphy, but is equally well adapted for regular lines, and is already in operation in various places. Several city lines in this city are equipped with it, and the Baltimore & Ohio Telegraph Company and Railroad have it in operation between Baltimore, Harrisburg and Pittsburgh.

The "phone" local battery only requires three to four cells for the longest distances, say two or three hundred miles. As stated before, the operation of the system is extremely simple, and the condition and length of the line has no effect upon the working. We believe that the system is destined to a rapid spread. Its simplicity is one of the strongest points in its favor.

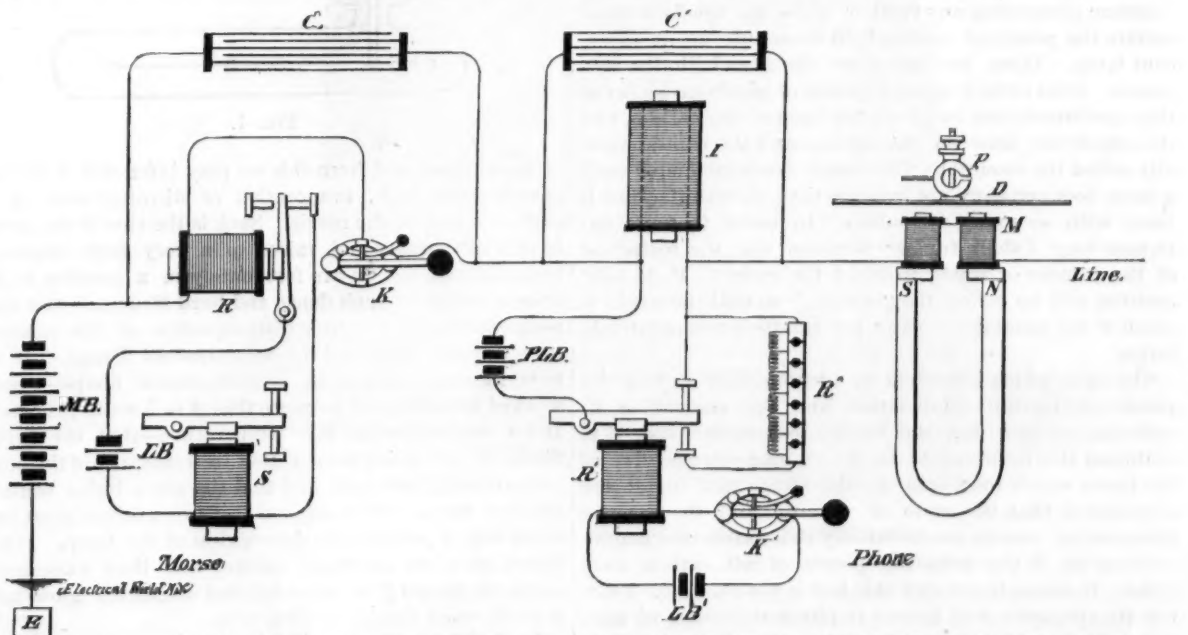



FIG. 1.—THE EDISON "PHONOPLEX" OR "WAY-DUPLEX"—DIAGRAM OF CIRCUIT.

### Novel Method of Finding the Strength of an Electric Current.

At a recent meeting of the Royal Society of Edinburgh, Professor Blythe, M. A., described a method of finding the strength of an electric current by means of an adaptation of the chemical balance. He said that he had been driven to try this method owing to the difficulty experienced in measuring currents in the ordinary way by the tangent galvanometer in a laboratory where there was a great deal of iron, and especially a dynamo machine. The apparatus depended on the calculation of the attraction between two parallel circles of copper wire of a certain radius, and at a certain distance apart. He had found that in such a case each time that the same current was passed through the copper wire an invariable result was obtained. In the apparatus which the learned professor described, these circles of copper wire were made to take the place of the scale pans of the balance, the wire being carefully insulated between discs of glass. The current was made to pass through the coils, over the scale beam, and through the support of the scale beam, care being taken not to interfere with the sensibility of the balance.

### Geese Crossing an Electric Railway.

When the electric street railway was first opened in Baltimore, the conducting rail was left exposed, the engineers knowing there would be no danger to life from the low tension electrical current employed. There was, of course, no danger to human life and little inconvenience to persons who accidentally got within the circuit, but most of the lower animals are much more susceptible to electric shocks than human beings, and there were many amusing sights seen among animals that got accidental shocks. Horses and pigs were very sensitive to the electricity and manifested stirring emotions under its influence. But the most entertaining sight was when a flock of geese came waddling along and got on to the rail. The leader would proceed unconcernedly until he raised one foot upon the rail, then he would spring back with a wild quack and look round with an indignant stare to see who had committed the outrage upon his dignity. Seeing nothing that he could reasonably blame, he would utter some voluble remarks in which he would be joined by a chorus of the whole flock. Then he would make another start and again get into the electrical current, when he would tumble backward, screaming and quacking, all his companions joining in to swell the tumult. They would keep making the wildest noises for a few minutes, running hither and thither in search of something to pour their wrath upon, but carefully avoiding the rail. After they tired of this performance they would fly in a body over the track, sending forth their fiercest notes of defiance and contempt, but that same flock of geese would never again be seen waddling over the electric railway.—*Ex.*

## Electrical Lighting by Means of Low-Resistance Glow Lamps.*

BY ALEXANDER BERNSTEIN.

It is not uncommon in the history of technical science to find that constructions which have at one time been abandoned on account of apparently insurmountable difficulties have, after a certain lapse of time, been readopted. The high-speed engine, the high-pressure boiler, the multiple telegraph system, were known and made long before they were generally applied, because their practical application was impossible until a certain amount of experience had been obtained by means of the low-speed steam engine, the low-pressure boiler, and the single telegraph system.

In a very similar manner the low-resistance glow lamp was known and made more than thirty years ago, but has hitherto been considered impracticable. In the meantime the glow lamp of high resistance has made its way, and has met with considerable success. Now, to-night, I desire to revive the older type of lamps in a new form produced by means of our present experience, and to show at the same time the way in which these lamps may be made to answer the purpose of electric lighting.

As we have been so often told that the lamp of low resistance is neither practical nor economical, I must suppose that most electricians are somewhat prejudiced against it. But prejudices are detrimental to the development of truth, and I must therefore request you to take as impartial a view as possible of the case which I shall lay before you to-night.

High or low resistance of glow lamps is not merely a question of construction of the lamp itself; it is a question of principle which determines the whole system of lighting. The requirements of the dynamo, the sizes of the conductor, and the whole system of arranging the circuit are entirely dependent upon the lamp which we select. It is therefore not sufficient to compare different types of lamps in regard to their qualities as lamps; it is quite as essential to consider how the use of these lamps answers the practical purpose of electric lighting. I shall therefore divide my paper into two parts—the first dealing with the lamp itself, the second with the manner of its application.

In speaking of glow lamps, and considering their merits, I shall only take such lamps into consideration in which carbon is brought to a state of incandescence and emits light by reason of its elevated temperature. Although other substances may be used, experience has shown so far that none of them offer the advantages which are secured by the use of carbon, viz., the possibility of applying a very high degree of temperature. This is very essential, because the highest temperature implies the greatest efficiency; and efficiency, together with durability, are the two qualities which principally determine the merit of an incandescent lamp.

Before proceeding any further, allow me briefly to enumerate the principal parts which constitute an incandescent lamp. These are only four—the glass bulb, the conducting wires (which always consist of platinum as far as they are surrounded by glass), the light-giving carbon, and the connection between the carbon and the wires (generally called the mounts). The simple construction of such a lamp does certainly not indicate that its manufacture is beset with so many difficulties. In order to settle our terminology, I shall further mention that the reciprocal of the number of watts required for every C. P. of light emitted will be called the "strain;" so that the strain is small if the number of watts per candle is comparatively large.

The light which is emitted by incandescent carbon depends only upon its temperature and the amount of its radiating surface; but the energy which is required to maintain this light would be determined—irrespective of the losses which may occur in the lamp, and under the supposition that the state of vacuum and the exterior temperature remain unaltered—by those same two magnitudes alone, if the radiating power of all carbon were alike. It seems to me that this last is not the case. From certain analogies, well known in physical science, we may conclude that a black, sooty carbon will radiate more heat than a carbon of a dense grayish surface raised to the same temperature, and consequently the former will require a larger supply of electric energy to maintain it at the same temperature than the latter. This fact seems entirely borne out by observations made on glow lamps.

Let us now consider the peculiarities of a glow lamp of high resistance, say of 100 volts and 0.6 ampère. I select this lamp because it seems that this is approximately the highest resistance lamp which can be practically applied at the present time. At least, I can see no reason why the complicated expedient of a multiple-wire system should be used, if electric lamps can be made reliable when working at a much higher difference of potential and with a corresponding smaller current. As the lamp is only to take 0.6 ampère, the filament must be exceedingly fine in order to become sufficiently heated by this current, and moreover, the filament must be of sufficient length to obtain the necessary amount of light-giving surface. As soon as the current is passed through the filament, the latter is raised to a certain state of incandescence; and we shall therefore have to deal first of all with the effect which heat alone seems to have upon the carbon.

Heat has a general tendency to expand all substances; and as it was interesting to know how far carbon is subject to the same law, I have investigated this question by means of a lamp of the following construction: Two straight filaments are connected by means of a cross piece of platinum in the form of a T, which acts on a lever so arranged as to indicate ten times the elongation of the filaments when these are heated. The annexed sketch, Fig. 1, in which *A A* are the filaments, and *B* the indicating lever, shows the arrangement which was adopted. The experiment indicated that when the carbon was exposed to a strain of 3 watts per candle, the elongation of the filaments amounted to one 120th part of their length. It was further noticed that the rate of expansion was not constant, but increased with the temperature, although at the highest temperatures obtained the coefficient of expansion seemed to decrease again.

The fact that the carbon expands and contracts with every change of temperature explains why lamps with slender filaments are destroyed more quickly when subjected to varying currents than when they are fed by a constant and uniform current, such as that supplied from batteries.

When we look at a heated filament, we notice sometimes that one small spot is brighter than the rest of the filament. This is an indication of a flaw which will sooner or later produce the disintegration of the carbon at this particular spot. These flaws are, for the most part, so minute that they cannot be perceived in the filament when cold, and only gradually show themselves when the lamp is being used. This is one of the causes which produces premature destruction of the lamp. The finer the filament the greater the danger of a flaw.

It has lately been supposed by some writers on the subject that the life of a glow lamp is in direct proportion to the diameter of the filament. Such suppositions, which are mostly made for the sake of obtaining mathematical formulæ, are far too sweeping; and all we are entitled to say is that, *cæteris paribus*, the lamp with a thick filament promises greater durability than the one with a thin filament.

We have before observed that heat produces expansion

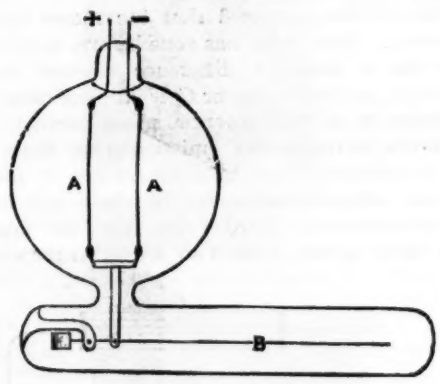



FIG. 1.

of the carbon, and from this we may infer that if the heat is sufficiently high, evaporation or disintegration of the carbon would be the result. Such is the case if the carbon is of a soft quality and raised to a very high degree of temperature; but we are fortunately in a position to produce a carbon of such dense and hard structure that there seems to be no perceptible disintegration at the temperature usually employed in incandescent lamps. If we, nevertheless, observe in high-resistance lamps—even if worked at a strain of no more than 4 to 5 watts per candle, and a corresponding low temperature—that the carbon filaments are disintegrated, that the resistance of the lamps consequently increases, and that the glass bulbs begin to blacken, we are led to suppose that other forces must be at work which produce the destruction of the lamp. These forces are of an electrical nature, and their existence is easily explained if we consider that an electric glow lamp is at the same time a vacuum tube.

In the high-resistance lamp we have considered before, there is a difference of potential of 100 volts between the two terminals of this vacuum tube. The fact very soon makes itself apparent in the lamp. If the temperature is sufficiently high, the negative side of the carbon assumes a dark, sooty appearance, and a deposit of black loose carbon is formed on the positive platinum and mount. This action of throwing off particles of carbon from the negative side towards the positive has been the subject of a very interesting paper communicated to the Royal Society by Mr. Preece. The peculiar behavior of high-resistance filaments is evidently the effect of a combined action of heat and electricity. The heat lessens the attraction of the particles for each other, and the electric forces produce motion. The result is the gradual deterioration and ultimate destruction of the carbon.

(TO BE CONTINUED.)

* Read before the Society of Telegraph Engineers and Electricians, March 25, 1886.

**McDonough's Teleologue.**—The McDonough people in Washington propose, it is said, to submit evidence in the telephone investigation, to prove that Mr. Butterworth, when Commissioner of Patents, was influenced to give his decision against McDonough, by the fact that his law partner was counsel for the Bell company.

## The Jenney Light in California.

The Jenney Electric Company, of Indianapolis, has just commenced the lighting of the enterprising and growing city of San Diego, Cal. The same company has also secured the contract for lighting Alameda. The San Diego plant is the first one installed on the Pacific Coast by the Jenney Company. The Alameda plant is to be completed and in running order by September.

The contract at San Diego runs for five years, and is for four towers, the price being $1,200 a year per tower. The lights give so much satisfaction, however, that one additional tower has been ordered and is now on the way. There is also a probability that still more will be ordered. Each tower is equipped with six 2,000 candle-power lamps.

After the plant had been started and was accepted, there was a little hitch, owing to a slight accident to the new engine. This has now been remedied, and the lights are once more brilliantly burning.

The officers of the local gas company lost their heads at the prospect of competition from the new illuminant. They had been charging the good round price of $5 a thousand for gas, but as soon as the electric light was ready, they reduced the price of gas 20 per cent., with the promise of even still further reduction. When the electric light stopped temporarily, they rubbed their hands gleefully and said, "We told you so."

Mr. L. M. Vance, who came out from Indianapolis, is superintendent and electrician of the station; Mr. John Green is the engineer and Mr. W. Morgan, trimmer and lineman.

In addition to the city lighting, the San Diego Electric Light Company has already subscribers for 30 private lights at the rate of $15 a month for each light. The number of subscribers will probably increase considerably, for the city is growing with remarkable rapidity. The population has doubled during the past year. It is now probably about 8,000 or 9,000, and the great activity in the real estate market and in the building trade indicates that the "boom" is likely to continue for some time to come.

As yet only the arc system has been introduced in San Diego, but the company proposes also to supply incandescent lights from its central station, and will probably have these in operation in about two months. At present the station is equipped with two 30-light dynamos, but another 30-light machine is on the way, which will make the capacity of the station 90 lights. The engine used is a Buckeye of 70 horse-power. This style of engine is largely, if not altogether, used in connection with Jenney plants, and is very highly spoken of for electric lighting purposes. It is also extensively used by other companies.

The advent of the electric light in San Diego called forth the following verses from a local poet. They were republished in a recent issue of the daily *Union* and will probably interest readers of THE ELECTRICAL WORLD:

Tell me, Mr. "Jenney" man,
How you "strike" a light;
Do you climb those iron poles
With your matches every night?
I know the climb it here is good;
But is that the way you do?
Tell me, Mr. "Jenney" man,
For I wish I knew.

Tell me, Mr. "Jenney" man,
Will it be very bright?
And who is this "smart Aleck"
That got up this Aleck trick light?
Surely he's a Boston man,
And cultured very high.
Tell me, Mr. "Jenney" man,
Will he be here bye and bye?

Tell me, Mr. "Jenney" man,
Will it shine just like the moon?
Will we have to light a lamp
When we go into our room?
Will we have to take a lantern out
When to church at night we go?
Excuse me, Mr. "Jenney" man,
But all this I'd like to know.

San Diego flourishes, in spite of its poets and poetry.

## The Philadelphia Pole Tax.

Judge Hare, of Philadelphia, has rendered an opinion that the decision of the referee in the suit brought by the city against several telegraph and telephone companies to recover the license fee of $5 upon telegraph poles, that the fee was excessive, could not be sustained, and referred the case back to the referee for reconsideration. He says:

"The question is not, in our opinion, merely what it will cost the city to take care that the poles and wires are sound and in good order, and do not by 'fouling' the city wires hinder the transmission of police messages and fire-alarms. It is an established principle that remuneration should be in proportion not only to time and outlay, but to responsibility, and a public or private agent who is exposed to loss may demand higher pay. That such is the relation of the city to the various companies which have been empowered to occupy its streets with a view to gain is abundantly clear, and they should not grudge a reasonable compensation for the space they occupy and the risk

which is incurred on their account. That the rate cannot readily be determined is no doubt true, but this circumstance affords an argument for the city, because there is a presumption in favor of the acts of public bodies within the scope of their powers. The question is not, would we name $5 as a reasonable fee, but is it so plainly in excess as to render it our duty to reverse the decision of Councils? On this point, as I have already intimated, we are of opinion with the city, and therefore sustain the exceptions which she has filed."

### Hedges' Speed Indicator.

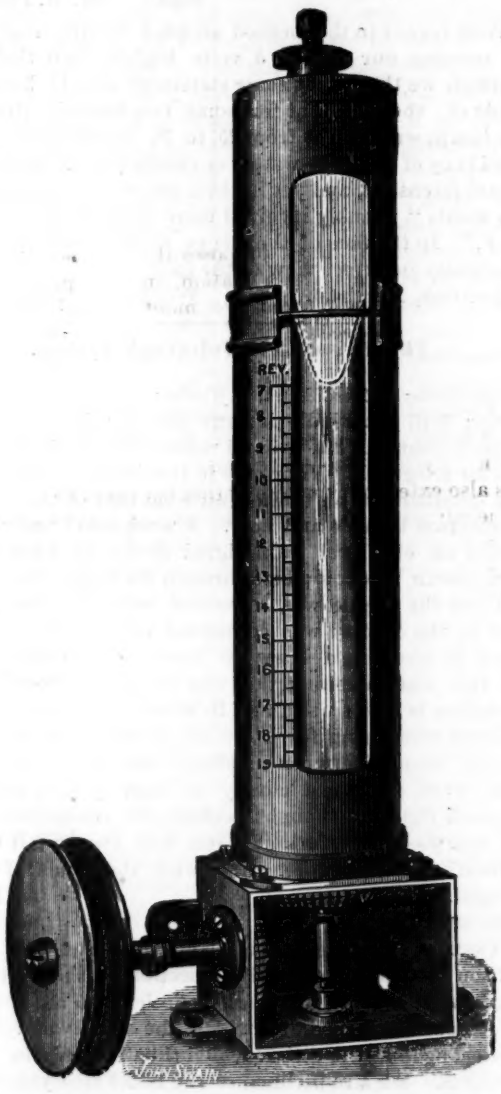
One of the most useful adjuncts in the dynamo room, and, in fact, in any situation where machinery is at work, is a reliable speed indicator. The ordinary hand-revolution counter serves its purpose quite well, but where it becomes necessary or desirable to note the speed continuously, some other form of apparatus must be applied. Many forms of such continuous speed recorders have been designed. One of the most simple and reliable that has recently come to our notice is that of Mr. Killingworth Hedges, the well-known English electrician.

The apparatus is designed to employ the familiar phenomenon of the peculiar form which the surface of liquids take when revolved in inclosing vessels. As will be seen in the accompanying illustration, the apparatus consists of a cylindrical glass tube sealed at the top and bottom, and partly filled with a transparent fluid which is unaffected by cold; at the lower end it is mounted on a spindle, while a cap at the top carries a pivot running in an adjustable centre, which can be set up to compensate for wear. Upon the spindle is a bevel wheel gearing with a wheel in the main spindle, at the end of which is the main driving pulley. The glass tube is covered with a metal case pierced with a pair of slots for sight holes and carrying a scale; when the tube is put in rapid rotation the edges of the upper surface of the liquid creep up the glass, while the centre becomes correspondingly depressed, a parabolic cavity being formed, which is exceedingly definite. The point of this cavity is the index, and its position can be exactly aligned on the scale by sighting it with the aid of a band which can be slid up and down the external case.

As illustrated, the indicator will read any speed between 700 and 1,900 revolutions. If required to have a more open scale that would register to one or two revolutions, this is easily arranged by driving the indicator at a higher speed than is registered on the scale, which will cause any change in the speed to be shown with an apparently greater depression for an increase in the number of revolutions.

Thus, for instance, the scale in the indicator shown may be made to read from 70 to 190 revolutions by merely altering the diameter of the pulley on the shaft or the pulley of the indicator.

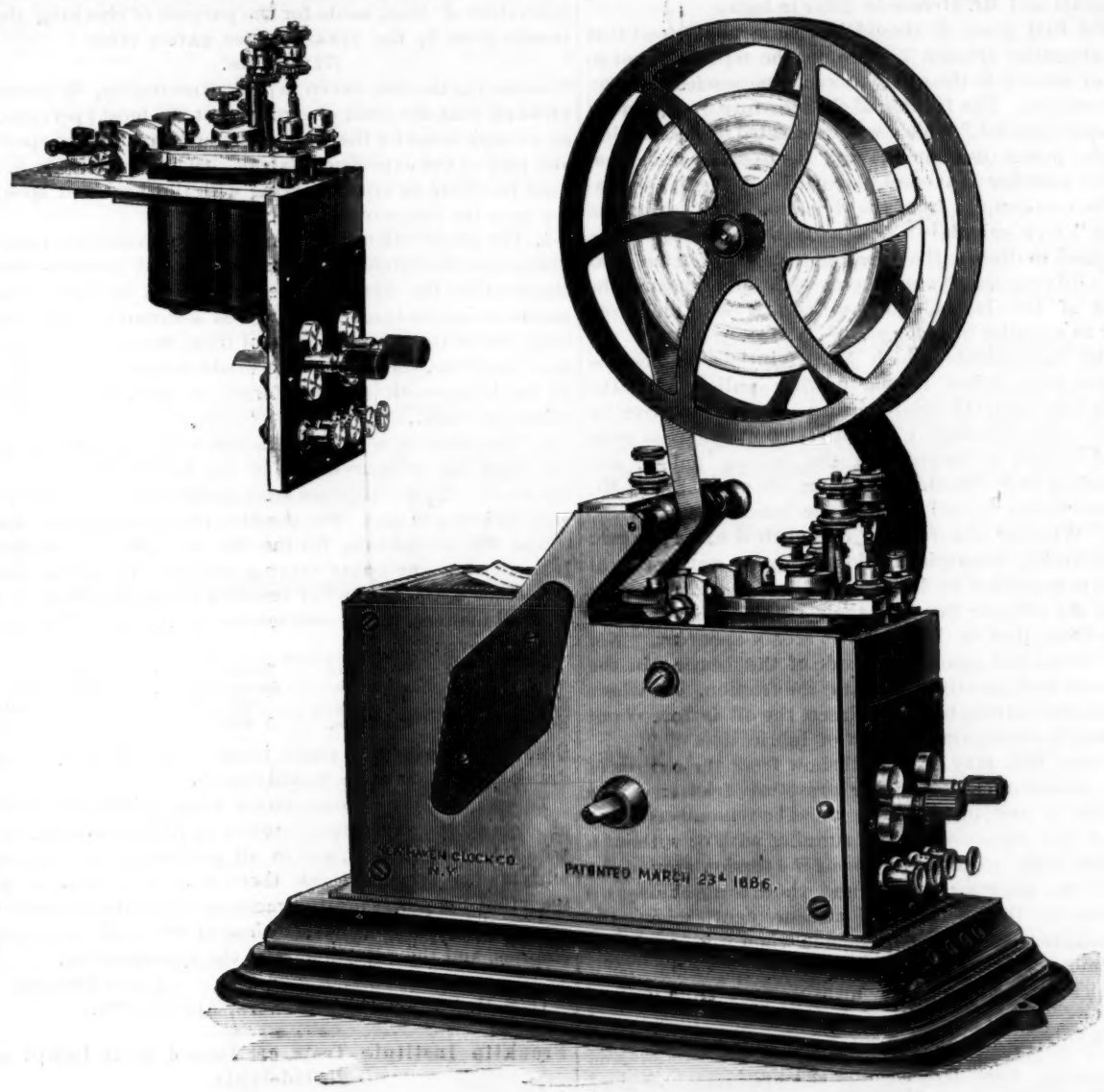
The simplicity of this speed indicator is evident, and its reliability has been indorsed by many foreign engineers. We may add that Mr. Wm. Callender, representing the Callender Company in this city, has taken the agency of this speed indicator in America.



THE HEDGES SPEED INDICATOR.

### Queer Freak of Lightning.

A remarkable effect of lightning has been recently reported by Prof. L. Weber in a German serial. At Ribnitz, in Mecklenburg, during a violent thunderstorm, with rain and hail, about 6 A. M., the lower pane of a window on the first floor was broken by lightning, and a jet of water was thrown upward through the aperture to the ceiling, where it detached part of the ceiling; and this, falling with the water, broke a small cigar table below. Three bucketfuls of water were afterward taken from the room. The hole in the window was like that from a bullet, and there were radial cracks. The path of the lightning is not very clear, but that it passed through the glass could not be doubted. Some cigars on the table, it may be mentioned, were carbonized. As to the jet of water, Prof. Weber rejects the hypothesis of a sudden generation of vapor forcing up water from the street. Another explanation offered is that the lightning, passing through the window to the street, generated a vortex of air about itself with vacuum in the interior, through which the water was driven as through a tube. A third hypothesis remains, viz., that a conical *trombe* or waterspout struck the street, was reflected and passed through the window in the form of a jet of water. In this case the lightning would merely have accompanied or preceded the *trombe*. Prof. Weber seeks further light on such phenomena.—*Nature*.




FIGS. 1 AND 2.—NEW MORSE REGISTER.

### A New Register.

While the Morse register has practically become obsolete in this country in connection with the telegraph service, it nevertheless is constantly gaining prominence and increasing application in connection with the district-messenger call, burglar, fire-alarm and other special systems which are now multiplying so rapidly. Being frequently left in charge of unskilled persons, it becomes desirable to have the apparatus so arranged that inspection and adjustment, when necessary, can be quickly and reliably performed.

Recently the New Haven Clock Company, of this city, have designed a register which embodies a number of very interesting and novel features, making it well worthy of description.

One of the principal features of the apparatus is the independence of the electrical from the purely mechanical part. As will be seen in the accompanying illustrations, the entire electrical part is carried on an L-shaped bracket, which is shown in detail. Upon this bracket are mounted the magnets, levers, etc., and the whole can be slid out by pressing the latch-pins (one on each side) shown at the end of the casing. In this way the electrical part can be inspected at all times without disturbing the wheel train and without removing a single screw.

Instead of the styluses usually employed for making the impression upon the paper, a cutter-wheel is placed at the end of the armature levers, so that the paper is not liable to tear, and can also be drawn through with less power. At the front end of each armature lever there will be seen a pin which passes down into the case and strikes against a lever below, which is connected to the wheel train and regulates the speed of the paper. This can be varied by the adjusting screws at the end of the armature levers. As the latter are allowed more or less play, the pins depress the lever below to a corresponding distance, so that the wheel train to which it is connected runs off a corresponding length of paper.

There are a number of other devices in connection with the paper adjustment, among which is the arrangement which allows any width of paper to be used. As will be seen, the paper upon leaving the reel passes over a guide before reaching the rollers. The discs forming the sides of the guide are adjustable by the thumb-screw at the end of the spindle upon which they are mounted, and so can be separated to the exact width of the paper. In order to deliver the paper perfectly flat to the impression of the cutters, the paper, as usual, is passed between two milled rollers. In the usual form one of these rollers is made adjustable by springs at the bearing points. In the present apparatus both rolls are fixedly mounted in a separate pivoted frame just within the one which carries the paper-guide and hidden by it. The adjusting screw shown on top of the outer frame presses down on the top of the inner frame which carries the rolls, so that the latter, although they are at a fixed distance apart, can be given any inclination. In this way the paper instead of coming toward the rolls in a plane at right angles to that of the latter, can be made to come obliquely, so as to bear upon a certain length of the circumference of each roll. Thus it is delivered flat over each cutter. There is also a device employed for preventing the unwinding of the paper from a sudden starting of the reel. This consists of a coiled spring placed on the spindle and bearing against a washer next the reel and against an adjusting screw at the end of the spindle. The tension of the spring can be varied at will and acts as a brake upon the reel and prevents the paper from unwinding. There is still another point worthy of notice, and that is the plug switch, which is mounted on the front of the case. An ebonite plate is screwed to the latter, to which the switches and binding posts are attached. In this way the base of the instrument is considerably decreased in size, and by bringing in the wires through the small holes in the base, the latter need not be removed for any inspection of the circuits which need not be broken, even when the L bracket is slid out.

As will be seen, the apparatus is a double register of very compact form. It is of brass, finished throughout even to the paper reel, and thus has a handsome appearance.

## The Franklin Institute Tests Defended.

*To the Editor of The Electrical World:*

Sir: My attention has been called to criticisms by Mr. Heinrichs on the recent tests of dynamo-electric machines made at Philadelphia. I have not considered it necessary to answer them before, but a communication addressed to the Franklin Institute having been sent me, I think it best to give my reasons for believing the criticisms unfounded.

I will not attempt to correct the many errors into which Mr. Heinrichs has fallen—for example, a seeming belief that the frictions of all six pulleys of the dynamometer enter into the measurement of dynamometer friction; a misconception of the method of calculating the "total efficiency," etc., etc., for although these are vital points, yet they are clearly explained in the report which Mr. Heinrichs criticises, and I will not occupy valuable space in repeating them.

The substance of Mr. Heinrichs' criticisms is that the armature friction is in error, for it is much smaller than results obtained by himself and at the Crystal Palace Exhibition. Assuming this view to be true, he argues that the rest of the power measurements are incorrect, and substituting other values of armature friction than those obtained by the committee he obtains impossible results for the efficiencies.

Euclid used the *reductio ad absurdum* by altering the proposition and showing a consequent absurd result, thus proving the proposition *true*. Mr. Heinrichs uses it by altering the proposition and showing an absurd result, as an argument to prove the proposition *false*, which shows how Euclid and Mr. Heinrichs differ in logic.

In the first place, it should be clearly understood that the "armature friction" given in the report did not in any way enter into the calculation of efficiencies made by the committee. The friction of the armature was included in "power applied," which was calculated by subtracting from the power used in driving the dynamo and dynamometer together that employed in driving the dynamometer when uncoupled from the dynamo. The "armature friction" was calculated separately by subtracting the power used in driving the dynamometer alone from that used in driving the dynamometer with the armature, the brushes of the latter being raised; it was measured merely as a matter of interest.

In the experiments which Mr. Heinrichs quotes the dynamos were belted to the driving pulley, and the brushes bore upon the commutator; in the data given by the Franklin Institute Committee, the dynamos were coupled directly to the shaft of the driving pulley, and the brushes were lifted. In making his comparisons Mr. Heinrichs seems to assume that the conditions were the same. Whether the friction of unbelted axles has ever been accurately determined I do not know, nor am I at present in a position to discover. I have never seen any data on the subject; but that their friction should differ greatly from that of belted axles seems apparent. Not only does the pull against the side of the bearing in the latter case tend greatly to increase the friction, but where the axle and bearing bind the closest the oil is forced out and there is a comparative want of lubrication.

However this may be, I shall show from the records of power measurements that the armature friction can be but little if any in error. It must be remembered that whether the dynamometer is running with or without a load, the scale readings represent the torsion around the axis of the drawing pulley, and there is absolutely no difference in the methods of measurement when the dynamometer is running alone and when it is coupled to a dynamo.

I select at random a power measurement from one of the tests.

| Dynamometer with dynamo, full load. | | | Dynamometer and armature. | | | Dynamometer alone. | | |
|---|---|---|---|---|---|---|---|---|
| Time. | Scale beam. | Counter. | Time. | Scale beam. | Counter. | Time. | Scale beam. | Counter. |
| 4.30 | 335 | 1320 | 4.54 | 21.5 | 8640 | 5.13 | 19 | 3701 |
| 31 | 335 | 2375 | 55 | 21. | 9676 | 14 | 19 | 4741 |
| 32 | 335 | 3434 | 56 | 21. | 0714 | 15 | 19 | 5788 |
| 33 | 334 | 4497 | 57 | 21. | 1755 | 16 | 19 | 6823 |
| 34 | 334 | 5556 | 58 | 21. | 2793 | 17 | 19.5 | 7862 |
| 35 | 332 | 6620 | 59 | 20.5 | 3831 | 18 | 19.5 | 8907 |
| 36 | 332 | 7674 | ..... | ..... | ..... | 19 | 19.5 | 9943 |
| 37 | 332 | 8736 | ..... | ..... | ..... | ..... | ..... | ..... |
| 38 | 330 | 9792 | ..... | ..... | ..... | ..... | ..... | ..... |
| 39 | 329.5 | 0850 | ..... | ..... | ..... | ..... | ..... | ..... |
| 40 | 329.5 | 1908 | ..... | ..... | ..... | ..... | ..... | ..... |

| | |
|---|---|
| Scale beam with dynamo | 332.54 |
| " without " | 19.21 |
| Dynamo requires (scale divisions) | 313.33 |
| Mean revolutions | 1,058.68 |
| " horse-power (= 313.33 × 1058.8 × 1.0025) | 33.25 |
| Scale beam with armature | 2 |
| " without " | 19.21 |
| Armature requires (scale divisions) | 1.79 |
| Mean revolutions | 1,038 |
| " horse-power | .186 |

We see that the armature friction is the difference of two quantities, which when calculated are:

| | |
|---|---|
| Power with armature | 2.189 horse-power. |
| " without " | 2.003 " |

These two measurements are made under precisely the same conditions, at nearly equal horse-power, and within a few minutes of each other. If the two values were in error in the same way, then in order that the difference, or armature friction, should be so great as one h. p., both results would have to be increased about five times, giving for the friction of the driving pulley over ten h. p., which is, of course, impossible. In fact the only way we can imagine any great error in the difference of measurements made under conditions so exactly the same is by supposing a sharp error in the scale beam between the two readings. As the measurements of other machines give similar results we would have a number of such errors at different points on the beam. It is not necessary to discuss this source of error except by stating that the beam was graduated by Brown and Sharpe, and carefully tested, as is explained in the report of the committee.

But what may, perhaps, surprise Mr. Heinrichs, is the fact that while the friction of an armature weighing several hundred pounds is something less than two h. p., that of a pulley weighing possibly 100 lbs., and measured at the same time and under the same conditions, is two h. p., and under other circumstances varies from .69 h. p. at 600 revs. (not very tightly belted) to 2.803 h. p. at 1,400 revs. (with the belt very taut to prevent flapping). The explanation is simple and at once apparent; the armature axle was not belted at all, but coupled up directly, and, therefore, its friction was slight, while the pulley was belted tightly, and the friction increased not only with the speed, but with the tightness of the belt.

So much for the armature friction. As for the correctness of the power measurements in general, I would state for the benefit of those who have not read the report under discussion, that a determination of the mechanical equivalent of heat, made for the purpose of checking the results given by the dynamometer, gave a value

772.8 ft. lbs.

Considering the care taken in the experiments, it seems probable that the limit of error was at the most ½ per cent., so we may consider the dynamometer correct at the speed and load of the experiment (about 700 revs. and 45 h. p.). That there are no errors varying with the load and speed we have the following evidence:

1. The power calculated from the dynamometer measurement is the difference of two measured powers—that absorbed by the dynamometer alone and by the dynamometer and its load. If there was a variation with the load, one or the other, or both, of these would be in error and, therefore, their difference would not be correct; but in the experiment above referred to there was no such source of error.

2. That there is no great variation with the speed I infer from the measurements of the Edison Nos. 4 and 5 dynamos. These machines are almost identical in design, only differing in size. For the first, the dynamometer was run at 600 revolutions, for the last at 1,400 revolutions. If there were any errors varying with the speed, this wide difference in the number of revolutions should show in a marked manner in the efficiencies of the two dynamos. Yet we have:

| | Weight of dynamo. | Speed of the dynamometer. | Commercial efficiency. |
|---|---|---|---|
| Edison No. 4 | 1,470 lbs. | 600 revs. | 88.44 per cent. |
| Edison No. 5 | 2,475 lbs. | 1,400 revs. | 89.19 per cent. |

Results that show a slight increase of efficiency with dimensions, such as we would expect.

To sum up: The dynamometer being (within the limits of error of the experiment) correct at 700 revolutions, and with a load of 45 h. p., and in all probability not varying with load or speed, I think there is every reason to believe that the power measurements given by the committee are as correct as the observations of the scale beam and counter, and the adjustments of the dynamometer.

Louis Duncan.

U. S. S. "Juniata," New York, April 8, 1886.

## Franklin Institute Tests on Incandescent Lamps at Philadelphia.

*To the Editor of The Electrical World:*

Sir: With reference to Mr. Tatham's letter in reply to ours on the above tests, we are sorry that we did not see Mr. Wahl's letter in the New York *Electrical Review* of June 20, which, however, we consider a somewhat weak denial in face of the strong assertions made by the *Electrical Review*.

Mr. Tatham states in his letter:

"In the conduct of the tests the cardinal principle was to do right, and also to *avoid all appearance* (the italics are our own) of wrong-doing. To this end a code was adopted and judges selected, with the full concurrence of the contestants, and nothing was concealed from the parties in interest. The contestants were invited to inspect, and did inspect, every step in the progress of the tests, and their experts compared the photometric measuring powers of the judges with their own."

We are surprised at the Franklin Institute again making the above assertions. We beg most emphatically to deny that a code was adopted or judges selected with our concurrence. We deny that we were ever informed of what was in progress, and we were never invited to inspect, nor did we inspect, any steps in the progress of the tests; nor had we experts to compare their photometric powers with that of the judges, but on the contrary, never heard a word of our lamps being tested until we saw in the London *Electrical Review* that the tests were practically over. Mr. Tatham is incorrect when he says the "boast of our lamps is that they are brilliant and cheap." To advocate them on account of their brilliancy would be manifestly absurd, and so far as cheapness goes, although our lamps are the same price to the general public as those of other makers, the trade are willing to pay, and do pay, a higher price for them than any other lamp. What we claim is that the efficiency of our lamps will be found considerably greater than that of other makes, while the life of our lamps compares very favorably with them.

As we have every confidence in our lamps, we are only too anxious to have them tested in competition with those of other makers, and we shall be happy to subscribe £50 towards any tests such as mentioned lately by Mr. Crompton.

With regard to Mr. Preece's statements, he had ample opportunity of testing the lamps at the Wimbledon trials, where they were run for some considerable time, our lamps being, we believe, the only ones of which none broke the whole time. As for the statement that some of the lamps were sent over by Mr. Preece specially to be tested by the Franklin Institute, the following is Mr. Preece's reply to our letters:

Gentlemen: The lamps tested at Philadelphia appear to have been some of yours sent by me to a personal friend, who omitted to give me the faintest idea of the purpose for which they were intended. Had he done so I should, of course, have told you. I had the pleasure of inspecting an installation recently where your 20 candle lamps have obtained an average life of 1500 hours, and many of them are now "alive and kicking" after 4000 hours work. They were 80 volt lamps running at 79 and taking .73 ampères, or 56.7 watts each. Yours faithfully,

(Sgd.) W. H. Preece.

With regard to the method adopted by the committee, of running our lamps 5 volts higher than they were marked, we think that some statement should have been made of the fact that for some considerable time then the lamps were run at from 25 to 32 candle-power, or an efficiency of about 2½ watts per candle-power (mean horizontal intensity), and yet in their report the committee use the words "possibly received more than their proper E. M. F." In the face of the above these words present a needlessly incorrect view of the case.

London, March 24. Woodhouse & Rawson.

## The Edison Air Telegraph System.

*To the Editor of The Electrical World:*

Sir: Will you kindly inform me in what manner Mr. Edison connects his ground wire to the trucks of cars in his air telegraph. Your cuts in the issue of March 6 are not detailed enough to show on what part of the truck the connection is made and how. A week ago I had occasion to test an electrical train signal device by which the return circuit was completed through the rails. The ground wire on the engine was connected with the driving box; that on the caboose was connected on the oil box of the truck by screwing a brass set screw into one side of the oil box and fastening the wire to it. A closed circuit vibrating bell was used, and in some portions of the track the bell would ring for a second or two, then stop. This would occur between stations and on sidings. The rails were examined closely at these places, and they were all right. I thought perhaps the connection on the oil box was imperfect. If you will kindly tell me Mr. Edison's plan of connecting with the truck, I will be obliged. A. D. B.

Richmond, Va.

Answer.—On the Staten Island train, equipped on the Edison system, the ground connection was made through a grooved brass collar, which encircled the axle of one of the trucks. A brush, to which the wire was attached, pressed against the collar, which thus formed the desired contacts. We are inclined to the belief that your trouble is with the rails rather than with the oil-box connection. —Eds. E. W.

## The Amperevolt Solution.

*To the Editor of The Electrical World:*

Sir: I find in your issue of April 3, under the "Business Notices," a paragraph bearing upon the ampèrevolt solution, in which the statement is made that a recent test of the ampèrevolt solution after 65 hours constant work on 55 ohms resistance showed the E. M. F. of the battery to be .03, the current, .10 ampères, and the internal resistance .03 ohm.

The above statement to me is not clear, because nothing is said of how many cells were put on that resistance.

I dare not assume that it was one cell, for then it would give Messrs. Theo. L. C. Gerry & Co.'s solution no credit whatever, and if, on the other hand, I take it for granted that one cell was meant, I should say that if on such high external resistance after 65 hours constant work the potential of the battery was .03, it certainly can be of no value for electric lighting.

I also fail to see how, with an E. M. F. of .03 and an internal resistance of .03 (which is extremely low) one can obtain .10 ampère.

It would be interesting to know what type of battery was used, how much ampèrevolt solution it contained, and also the size of the elements. Wm. C. Goldner.

Boston, April 5.

## Imperfect Condensers.

*To the Editor of The Electrical World:*

SIR: In your issue of Dec. 5, 1885, Mr. T. D. Lockwood, in a letter on "Condensers in Telephony," states that his worst trouble was that the condensers proved first-class lightning traps, and at every little display of nature's fireworks he found himself in possesion of half-a-dozen damaged condensers. Now such a statement coming from a gentleman of Mr. Lockwood's acknowledged abilities might influence others against the use of condensers for experimental or practical purposes. I would say that Mr. Lockwood must have used very imperfect condensers, as out of hundreds that I have made for service in all parts of the country I have never had one returned to me that was burned out by lightning, nor, in fact, by any other cause.

I have, however, repaired many condensers, the damaging of which had been attributed to lightning, but which, in reality, had been caused by the passage of ordinary telegraph currents through originally defective portions of the condenser. WILLIAM MARSHALL.

NEW YORK CITY, April 10.

## Pan-Electric Investigations.

Among the later witnesses in the Pan-Electric investigation is Gen. Joseph E. Johnston, Commissioner of Railroads, who was examined by the committee on the 7th inst. He said he was one of the original six stockholders in the Pan-Electric Campany, and had joined upon the invitation of Senator Harris. The association paid nothing for their interest, but were to do what they could to put the instruments in use, and the mode adopted was by selling State rights. He had never heard of sales of Pan-Electric stock by any of the holders except Mr. Rogers. As a matter of common honesty, the associates thought the stock should not be offered for sale until it proved of value. If the stock had been put upon the market before the success of the company became assured, the purchasers would have been swindled. It was not until long after the organization of the company that they heard of Bell's broad claim to the art of telephony, and the Pan-Electric Telephone Company was not aware of any infringement when territorial rights had been sold. If that had been known, no rights would have been sold. Witness was very sure the idea of using official influence to further the interests of the company had never been thought of by his associates. On the 8th inst. Mr. Gardiner, Secretary of the Washington Pan-Electric Telephone Company, testified that $10,000 worth of its stock had been sold for cash, the money being expended in the purchase of plant. Stilson Hutchins, of the Washington *Post*, was also a witness on the 9th. Being questioned by the chairman as to his offer to buy Senator Vest's Pan-Electric stock, he gave a history of the transaction. An advertisement had appeared in the columns of his paper offering to purchase Pan-Electric stock, and Senator Vest, who was ill at the time, had sent witness a note asking him to come and see him. Witness had gone to the Senate chamber and saw Senator Vest in the lobby. The Senator wanted to inquire whether he knew who was the author of the advertisement in his paper. Witness did not know, and after inquiry had failed to find out. He returned and told Senator Vest that he could not find out, and the Senator said that he had a certificate for 100 shares of Pan-Electric stock. He said that the newspapers were making so much clamor about it that if he could find a bona fide purchaser for it he did not know but he would sell it. In a spasm of generosity, witness supposed, he told Senator Vest that he would take the stock at the price the Senator had paid for it. The Senator made no conclusive response at the time, but afterward wrote to witness thanking him for his offer and stating that, considering the clamor to be unjust, he had come to the conclusion that he would retain the stock. Witness had the note, if the committee desired to embellish the proceedings with it. Witness never had a share of the stock, and witness knew nothing about its value at the time he made the proposition.

Mr. Van Benthuysen, President of the National Improved Telephone Company, was before the Committee on the 12th, and gave the particulars of his connection with the movement to bring a Government suit against Bell. He accused Mr. Ranney, of the Committee, of being a representative of the Bell Company. This was hotly denied by Mr. Ranney. The Chairman inquired if it was true that copies of the Interior Department proceedings had been printed for the New Orleans suit with important omissions. The witness replied with a great deal of heat that that was another lie circulated by the Bell Company. The Nipher affidavit had been dropped, he said, because it stated that Bell's instrument, as described in the specifications, would work, while Professor Bell himself had failed to get speech through it. "The Bell Company has circulated the report that it was a trick on the court," explained the witness. "Those who circulated it are liars, and they know that they are liars." The hearing was altogether of a very lively nature.

**St. Paul, Minn.**, has an Edison Electric Illuminating, Power and Heat Company, with a capital stock of $100,000.

## A Novel Induction "Killer."

Many devices have been invented for the purpose of removing or neutralizing the effects of induction currents in telephone circuits. The effects of induction are well known, and they may be said to be the only enemies with which the telephone has to contend. The problem of removing induction is a comparatively simple one when a metallic circuit is employed, but with the earth return the question assumes another aspect and greater precautions must be taken.

In a recent number of *La Lumière Electrique*, M. E. Gimé describes a very simple piece of apparatus with which he has experimented, and which he says has given him better results than many other reputed anti-induction devices.

The apparatus, which is connected in series with the

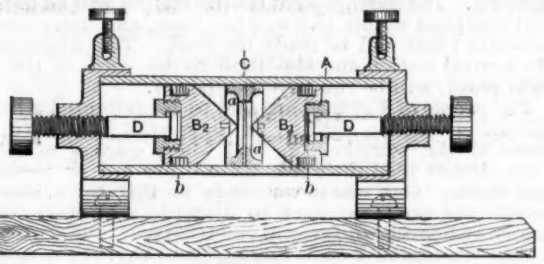



FIG. 1.

telephone circuit, is shown in section and perspective in Figs. 1 and 2. *L* is a glass tube separated into two parts by a membrane or diaphragm *E*, of paper or parchment, which is placed between two washers of brass *a a*. $B^1$ $B^2$ are pistons which can be moved as desired by means of the screw rods *D D*, and are made air-tight by the packing *b*. The ends of the pistons are cone-shaped, and are tipped with sharp platinum points, which can be brought any desirable distance towards the paper diaphragm. The ends of the glass tube are closed by brass covers to which binding posts are attached.

The regulation of the apparatus is effected according to the various conditions of length of line subject to inductive influence, the total resistance of the circuit, and the

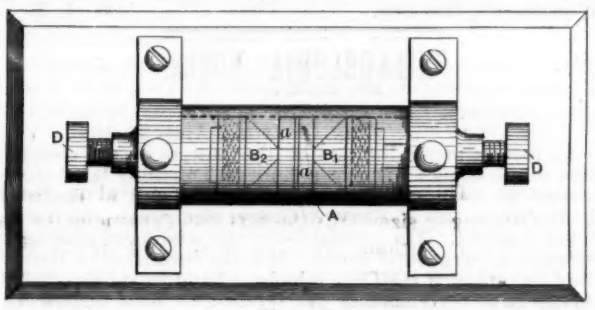



FIG. 2.

electromotive force of the telephonic or microphonic currents employed.

The free space between each cone and the membrane is filled with a reducing gas. An inspection of Fig. 1 will show that only the undulatory currents of very high potential produced by the magneto telephone or the induction coil will be able to pass from $B^1$ to $B^2$, whereas even the induced currents on the line will have too low a potential to overcome the enormous resistance presented to their passage.

On account of its construction, this apparatus can also be employed so as to make telephoning and telegraphing over the same wire possible. For that purpose a telephone and anti-induction apparatus are connected to each end of the

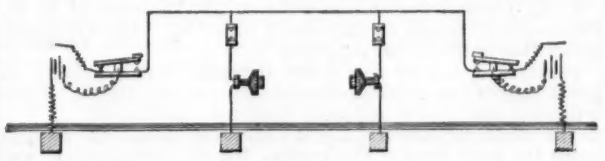


FIG. 3.

telegraph line and to earth, as shown in Fig. 3. The telegraphic currents have no appreciable effect upon the telephones, while the telephone currents do not affect the telegraph instruments.

By the use of this apparatus, a telegraph line can be converted into a telephone line at any point in a few minutes, on merely establishing the connections as indicated above.

## The Indiana Telephone Exchanges.

A meeting of the Judiciary Committee of the Indianapolis City Council and local representatives of the Central Union Telephone Company was held on April 3, to come to some conclusion respecting the further use of the streets of the city by the telephone company. The committee wanted the company to agree to serve all patrons who desired it so to do until June 30, at which date all contracts with subscribers expire, not cutting off the 474 whose contracts expired on the 31st ult. This the company declined to do, and after discussing the matter briefly the City Attorney was instructed to draft an ordinance repealing the one under which the company now operates, to be introduced at the next meeting of the Council.

It was stated at this meeting that the proposed arrangement by which a club of the patrons were to lease the exchange and operate it themselves had not been consummated, and it is not probable that it will be. The indications now are that the Bell telephone will be taken out of Indianapolis, and that in short order. The exchanges in all parts of the State are closing out, and there is much dissatisfaction caused by the retirement. Six hundred of the thousand poles in the city are strung with the city's fire alarm wires, and in case the company's charter is repealed it will be necessary for the city to erect a new system of fire alarm throughout. Besides the use of its poles the company gives the city the free use of 24 telephones.

There is little other change to record in regard to the telephonic deadlock in Indiana. A special dispatch from Indianapolis of April 10 says: Superintendent Beach, of the Central Union Telephone Company, has ordered managers of exchanges in the smaller cities of Indiana to notify patrons that the exchanges will continue to be operated as usual, and at the rates prescribed by law—$3 per month, and $2.50 per month where two instruments are rented by one party. The superintendent also urges the managers to bestir themselves in securing new subscribers, and to leave nothing undone which can compensate for the reduction of rentals. No exchange wires extending beyond the corporate limits of cities of less than 15,000 inhabitants will be rented to individuals. This was read to Mr. Wallick, the resident director, who said that was in accordance with the original intention of the board to continue the service everywhere that it could be done and expenses covered by receipts under the law. The circular applies to only small places, none of the cities being included in the terms of the circular. In these smaller places, according to Mr. Wallick, service can be rendered for the legal rate, but not in the larger cities.

The Central Telephone Company has established public telephone stations and the first was established yesterday. Two hundred and forty-nine phones have been removed. All of the instruments to be taken out at present will have been removed before the close of next week. The inconvenience resulting from the dropping of so many names from the exchange list begins to be seriously felt.

## Heat from Incandescent Lamps.

Herr Wilhelm Peukert, in the *Zeitschrift für Elektrotechnik*, gives the following results of his experiments to find the quantity of heat emitted by different lamps, incandescent and other, in an hour:

| | Units of heat. |
|---|---|
| Incandescent lamps: | |
| Siemens and Halske | 427 |
| Edison | 355 |
| Swan | 430 |
| Bernstein | 153 |
| Gas: | |
| Siemens regenerative burner | 1,500 |
| Argand | 4,860 |
| Two-hole burner | 12,150 |
| Petroleum: | |
| Round burner | 3,360 |
| Small flat burner | 7,200 |
| Solar oil: | |
| Schuster and Bauer's lamp | 3,360 |
| Small flat burner | 7,200 |
| Rape oil: | |
| Carcel lamp | 4,200 |
| Reading lamp | 6,800 |
| Paraffine candles | 9,200 |
| Spermaceti | 7,960 |
| Wax | 7,960 |
| Stearine | 8,940 |
| Tallow | 9,700 |

With regard to the value of the Bernstein lamp, M. Peukert thinks that it is possibly too low, owing to the fact that in the measurements losses of heat were not absolutely guarded against. The construction of the lamp was such that it could not be entirely immersed in the water employed to determine the heat given out.

## Another Deep Sea Lighthouse.

A new plan of deep sea lighthouses, invented by the late Captain Moody, has been illustrated by a large model constructed at the Barrow Shipbuilding Company's yard. It consists of a central vessel of iron or steel, divided into water-tight compartments, and having four rays projecting from it. An iron bulwark runs round the vessel, and scupper-holes are specially provided to carry off storm water. The vessel is anchored by four cables running from between the rays, and in deep water the cables would be moored to buoys anchored in the sea. In shallow water the cables run direct to the mooring anchors. A telegraph cable connecting the vessel with the shore runs through a hole in the centre of the hull, so as not to be fouled with the anchoring cables. A lattice tower of steel starts from the hull, and is to be fitted with a lantern 60 feet above the water line. The length and breadth of the central hull in actual practice would be 80 feet. Every accommodation for the lighthouse keepers and telegraphists would be provided, together with a sufficiency of stores. The hull is of an arched or curved form to resist the waves better, and, owing to its form and mooring, it can also keep its position in any state of wind and tide. The model, which was recently tried successfully at Barrow, s to be submitted to the Trinity Board, and sent later on

to the Shipping Exhibition at Liverpool. The question of ocean telegraph and lighthouse stations is no doubt a very important one, and it is likely enough to be realized in the future. Already a step in that direction has been taken in the case of the lightship off Walton, Essex, England, which is in communication with the shore by a cable some eight or nine miles long, laid by the Telegraph Construction and Maintenance Company, and worked by telephone and telegraph. Quite recently it did prompt service in calling out, and subsequently stopping, the district lifeboat before it put to sea, owing to the fact that the vessel which was in distress had succeeded in getting off the "ground" before the lifeboat was launched.

### Signal Service Flags.

The question is often asked as to the significance of the displayed flags of the government signal service. A rhyming officer of the service has formulated its entire flag code as follows:

A sun of red is weather warm,
A sun of blue is general storm,
A crescent of red is weather cold,
A crescent blue is fair foretold,
A star of red no change implies,
A blue star local stormy skies,
A square of black on flag of white
A cold wave coming in all its might.

## NEW YORK NOTES.

Office of The Electrical World,
New York, April 12, 1886.

Mr. J. H. Bunnell, of the firm of J. H. Bunnell & Co., 106–108 Liberty street, well known as one of the largest manufacturers of telegraph, telephone and electric light supplies in the United States, sailed for Europe on the 10th inst. in the Cunarder "Umbria." Many of his friends were on the pier to bid him *bon voyage*. He expects to be gone several months visiting the principal cities of Europe, for the purpose of meeting prominent electricians and others interested in electrical science and application. As the firm is ever on the alert to give attention to new specialties that will develop their business, the electrical community may rest assured that Mr. Bunnell will not fail to take advantage of any latest development of electricity he may see that is worthy of notice.

Mr. J. S. Watt, 81 Fulton street, is one of the oldest manufacturers of district telegraph cases and electric light hoods, and is just now giving these branches of business his special attention. He carries a large and full stock, and has every facility for turning out quantities at short notice. The electric light hood business is quite interesting in its way, and is another example of the manner in which a new development serves to create new demands and build up auxiliary trades. Mr. Watt undertakes to make electric light hoods of any special shape to order, and can give many a good point or suggestion.

It was said the other day that the electric lighting effects in the "Little Tycoon," now playing in New York, were one of the chief causes of its great popularity in Philadelphia. I can readily believe it. Many a scene in modern opera or spectacular drama owes its charm or power to electricity. One of the newest and most successful effects of the kind is that introduced by the Stout-Meadowcroft Company for the American Opera Company in this city. It is known as the "Firefly." Fine, invisible wire is suspended across the stage, and connected with a large spark coil and 24 "luminous points;" and the passage of the current causes an instantaneous flashing of the points all over the stage. The effect is so natural that the exclamation breaks out from all parts of the auditorium, "Look at the fireflies!" "Look at the lightning bugs!"

The Hecla Electric Light Company, 26½ East Forty-second street, New York City, manufacturers of the Jackson dynamo and lamps, are prepared to furnish arc and incandescent lights of any capacity. Their specialty will be small plants of 15 or 20 incandescent lights, the dynamo to be run by a two horse-power Shipman engine. This plant can be bought for $400. They have already put in two of these plants—one in New Haven and one in Boston. They will have one of the plants on exhibition in their office next week.

E. P. Bullard, manufacturer of metal working machinery especially adapted for manufacturers of telegraph, telephone and electric light supplies, has lately brought out a new turret lathe for brass work, which will amply repay investigation by electricians. Mr. Bullard carries a full line of Brown & Sharpe machines and tools. Factory, Bridgeport, Conn. Address, 14 Dey street, New York.

To electric light companies the National water tube boilers are especially recommended. They are made on the Moore system and are unequaled for durability, safety and economy. They can be quickly examined and cleaned. No boiler has a more rapid circulation. This boiler should be examined by all electricians before they place their orders. Send for circulars and testimonials to the New York Engineering Company, 64 Courtlandt street, New York.

Mr. T. N. Vail is home again. W. T. H.

## NEW ENGLAND NOTES.

Branch Office of The Electrical World,
Boston, Mass., April 11, 1886.

The B. & O. Telegraph Company has opened a very handsome office in the east corridor of the Boston Post Office, and another office on Chauncey street, in the heart of the dry goods district. This company is said to have secured the exclusive right to open a telegraph office on the base-ball grounds in this city, and to report by telegraph the results of each game during the present year.

The Consolidated Electric Light Company, through its New England agent, Mr. P. H. Alexander, has been awarded the contract for installing a new plant at Concord, N. H.

The Electric Light Company, at Manchester, N. H., finding their present plant too small for the increasing demand made for lights, are soon to erect a large and handsome brick building near the railroad.

The New England Telephone and Telegraph Company will hold its annual meeting in New York City, May 3, 1886.

The Laramie Electric and Manufacturing Company, of Laramie, Wyo., is putting in its plant three new boilers, having the Jarvis patent furnace.

Messrs. Paine & Francis, the New England agents of the Edison Company for isolated lighting, report the recent installation of their company's incandescent system in the Hollingsworth & Whitney paper mills, at South Braintree, Mass.

The New England agency of the Consolidated Electric Light Company is well represented at the fair now in progress at Amesbury, Mass., having on exhibition a very handsome plant of both arc and incandescent lights.

The Brush-Swan Electric Light Company's new plant at Milford, Mass., is giving great satisfaction to the citizens of that town. It is an arc plant of 600 lights capacity. The plant recently installed by the same company at Taunton, Mass., of 350 arc lights, is also meeting with the approval of its patrons. It is reported that the city fathers of Fairfield, Me., have awarded the contract to the Brush-Swan Company for lighting the streets, public buildings and large stores with both arc and incandescent lighting. The incandescent central station will be finished and equipped within two months' time, and later on the arc-light plant will be ready for work. The dynamos at the central station and also those to be used in the arc-light plant, will be run by water-power.

The people of Fairfield are said to be delighted with the advent of electric lighting in their quiet little town, and about all the store-keepers and many owners of houses have already filed their orders for either arc or incandescent lights. Gas was never made in this town, and the people are only too glad to dispense with their former modes of lighting in favor of electricity.

The Armington & Sims Engine Company, of Providence, R. I., has filled another order for a 60 h. p. automatic cut-off engine to the Bridgeport Electric Light Company, making the third engine of same horse-power shipped to the latter company within a few months.

The Jarvis Engineering Company, of Boston, reports having just completed the installation of sixteen Jarvis furnaces to the new boilers of the Louisiana Electric Light Company, New Orleans, La.

Mr. Albert L. Russell, who now occupies the old stand of Charles Williams, Jr., 109 to 115 Court street, Boston, has as fine and as varied a stock of telegraph and electrical instruments as can be found in this country.

The Merchants' Electric Light and Power Company of this city is steadily increasing its business and continues to grow in popularity. Recently the company has added new engines and dynamos to its plant. The business outlook of this enterprise is decidedly encouraging.

College students and others engaged on experimental work in electricity can obtain at reasonable prices castings for small dynamos and other apparatus at Goodnow & Wightman's, this city. W. I. B.

## PHILADELPHIA NOTES.

Branch Office of The Electrical World,
Philadelphia, April 12, 1886.

An interesting exhibition of the powers of the electro-pneumatic transit was given here on Thursday last before several scientific gentlemen, electricians and journalists, in the workshop of Shaw & Geary, electricians, 53 North Seventh street. The system is for the sending of messages through underground tubes. It is the invention of Henry Clay, inventor of the Clay telephone, and by its simplicity threatens to revolutionize the sending of local dispatches by wire or district boys. The main tube leading from the main office can have as many branch tubes running in any direction, right or left, as are necessary, and it does not require sub-stations along the main tube to turn the messages toward their place of delivery. Everything is worked from the main office. The message is placed in a metallic cartridge or carrier, and is shot to its place of destination in a moment. The inventor claims that the electro-pneumatic transit is a big improvement over the old pneumatic tube system, which requires two tubes running parallel, and that the operating expenses are about 75 per cent. less. The mechanical contrivances are few. The carriers, when placed in their proper positions, perform their allotted functions and transport messages and parcels of a diminutive size at the rate of a mile in thirty seconds.

The Novelty Company reports trade as increasing. It is the agent for the Ball unipolar system for electric lighting, and has just erected a 6-light plant at 17th street and Ridge Avenue.

F. A. Culin has purchased the supply business of R. K. Pearce, of 59 South Fourth street, this city. He will carry a full line of electrical supplies.

Partrick & Carter report the demand for box bells so great that it has been impossible to supply them. They will soon add a new and neat design to their stock.

The McTighe Electric Light Company made an assignment the past week. The reason for the assignment was said to be the failure of the Penn Bank. Another tale might be told if the business were properly pushed by advertising. E. F. I.

## WESTERN NOTES.

Branch Office of The Electrical World,
Chicago, April 10, 1886.

I had the pleasure of being shown over the Link Belt Machinery Company's establishment the other day. The building is a handsome five-story structure, with an aggregate floor space of sixty-seven thousand square feet. The whole building is fitted up with the mercurial fire alarm, watchman apparatus and other electrical devices. This company is one of the largest manufacturers of friction clutches in the country, and enjoys a large trade in this apparatus. The frictional parts of this clutch are entirely incased so that no dust can reach them, and by a judicious arrangement of oil chambers and channels the oiling of the surfaces is most perfectly secured. Requests for catalogues or letters of inquiry directed to the company at Chicago will receive prompt attention.

The Railway Telegraph Supply Company has very convenient and commodious quarters at 211–213 Randolph street, Chicago. Mr. M. A. Knapp, the manager of the company, reports an exceedingly satisfactory volume of business. The company will be glad to send its new catalogue (soon to be issued) to those requesting it.

The directors of the Board of Trade Thursday noon stopped the quotations of the Chicago Commercial and Financial News Company, alleging as a reason that the latter had allowed their quotation wire to be tapped for the purpose of supplying the markets to Nohe's bucket shop, in Pacific avenue. This action on the part of the board was a little rash, inasmuch as there are two injunctions now pending restraining the board from interfering with or stopping the quotations now furnished to the ticker company's regular subscribers. An investigation of the matter in the afternoon developed the fact that the quotation wire had been actually tapped for that purpose, but that it had been done by one of the employés of the ticker company on his own account and without the knowledge of the company. When the facts were known and the company found to be innocent of the act in intent, the directors of the board immediately voted to restore the quotation service on condition that the offending employé be summarily discharged. This arrangement was agreed to, and the service of the ticker was resumed next morning as usual.

As predicted by the writer last week, the negotiations between the citizens of Indianapolis and the Telephone Company, by which the former proposed to take charge of and run the latter's business in that city, have fallen through. The company is now making good its threat to take out the telephone, and so far about 200 instruments have been removed out of the 500 the contract for which expired March 31. The company's franchise has been repealed by the council. It is not as yet known whether the company will be compelled to remove their poles and wires immediately or not. In case this should be done, the city fire-alarm service will be badly crippled, as there are miles of fire-alarm wires on the telephone poles. There is some talk of getting the company to establish a few telephone stations through the city for the benefit of those whose telephones have been removed. In case this is done, a fee of five or ten cents per message will be charged. Is it possible that the citizens of Indianapolis are now willing to pay a fee of *five* or *ten* cents per message for telephonic privileges, when a short time ago they were not willing to pay *four* cents for these same privileges, and yet, according to the American Bell Company's report, the average cost to the subscriber, under the old conditions, of a telephone message was only four cents. Does not this show about how much reason there is in this whole, miserable agitation against the telephone company in Indiana? I am afraid that the proceedings of Indiana's Legislature are not calculated to attract foreign capital to that State. In fact, if this law is to form a precedent for other similar ones, the enactments of the state Solons will be more likely than anything else to drive out of the State what foreign capital is now invested there.

The Universal Electric Company, of which Mr. George S. Bowen, so well and favorably known among electric lighting people, is the general manager, is fitting up handsome offices at 196 Jackson street. The company's shop, corner Division street and Elston avenue, is being rapidly equipped, and in the near future I shall have much more to say concerning this organization.

Rumor has it that Mr. F. S. Terry, the popular manager of the Electrical Supply Company's Chicago house, is not to return alone from his Eastern visit, but that he will bring with him a partner of his future joys and sorrows in the person of one of Connecticut's fairest daughters. The bride and groom are expected in Chicago next Friday. The writer hastens to offer his congratulations.

Mr. C. O. Mailloux, who has been in Chicago several months in his capacity of electrician to the American Press Association, returns East this week, and will hereafter make his headquarters and have his main laboratory at the association's New York house. Mr. Mailloux has made many friends in the West, and his departure is regretted.

Mr. C. A. Brown, of the Western Electric Company, has just returned from a short trip East.

Col. S. G. Lynch, broker, 144 LaSalle street, Chicago, gives the following telephone stock values:

| | |
|---|---|
| Bell, of Missouri | $147@$151 |
| Chicago | 365@ 390 |
| Central Union | 50@ 52 |
| Colorado | 18@ 20 |
| Cumberland | 70@ 75 |
| Great Southern | 25@ 30 |
| Great Southern, Scrip, 65 cents on the dollar. | |
| Iowa Union | 15@ 18 |
| Michigan | 65@ 67 |
| Missouri & Kansas | 52@ 54 |
| Missouri & Kansas, Scrip, 53 cents on the dollar. | |
| Rocky Mountain Bell | 40@ 45 |
| United | 15@ 17 |
| Wisconsin | 108@ 110 |

W. A. K.

## THE TELEGRAPH.

**The Western Commuters' Telegraph Company,** of Chicago, has been incorporated with a capital stock of $500,000. Mr. G. W. Cass, 99 Washington street, Chicago, is one of the incorporators.

**District Telegraph Consolidation.**—The Williamsburg District Telegraph Company, Brooklyn, N. Y., has leased the lines, office and service of the Greenpoint District Telegraph Company, and introduced the Baltimore & Ohio lines and the Mackay-Bennett cable into that section of the city.

**Suit for Damages.**—Thomas A. Biddle & Co., stock brokers, Philadelphia, have filed a declaration in a suit against the Western Union Telegraph Company. They say that they have a cipher cable code with Haseltine, Powel & Co., of London, and on February 12, 1885, received a cablegram from London containing the words "habit and badger," which was a direction to them to buy 200 shares of St. Paul Railroad stock to make good a sale in London. The plaintiffs declare that no such dispatch was ever given to the telegraph company for transmission, and the consequence was that they had to sell the 200 shares at a loss. To recover this loss suit was brought.

**Land Grant Railroad Telegraphs.**—Gen. Wager Swayne concluded last week an argument before the House of Representatives Committee on Post-Offices and Post-Roads in support of the validity of the contracts between the land-grant railroads and the Western Union Telegraph Company. While not controverting the power of Congress to provide additional legislation on the subject, General Swayne pointed out some of the difficulties in the way of any legislation of a practical character. He thought such legislation inexpedient, and expressed a belief that additional legislation would necessarily result in a Government Commission to take control of the entire matter.

**Railroad Telegraph Lines.**—Commissioner of Railroads

Johnston appeared before the Post-Office Committee of the House of Representatives last week to explain the attitude assumed by the Interior Department in the matter of alleged discrimination by the Pacific railroad companies in favor of the Western Union Telegraph Company. He said that the Baltimore & Ohio Telegraph Company had solicited the aid of the Government in compelling the Pacific railroad companies to allow them to use their wires on like terms with the Western Union, but that the Interior Department felt that it had no authority in the matter. If Congress should see fit to confer the necessary authority on the department he believed that the matters complained of could be more speedily acted upon than through the medium of the courts.

**An Unsuccessful Inventor.**—An intricate and interesting machine which for over two years has stood in one of the committee rooms of the House of Representatives is to be removed. It has an interesting history. An old gentleman named Crosby, noticing with some degree of annoyance the immense amount of time lost in the calling of the yeas and nays, undertook to invent a machine which could record the votes almost instantaneously by the means of electricity. There were to be electric buttons at each Congressman's desk. The pressure of one recorded yea and the pressure of the other recorded nay upon a printed slip at the clerk's desk, while at the same time an ingenious arrangement moved the hands on the dial on the Speaker's desk and showed at a glance how many votes had been cast on each side. The inventor, after having had an expensive model made, was taken sick and was compelled to spend nine months in Florida. The next session was a busy one, and he could get no one to listen to a dissertation on the merits of his invention. This year his son fell sick and died, and he was not able to urge upon Congress the adoption of his machine. The Speaker will probably give orders to have the apparatus removed, for it fills up considerable space. Mr. Crosby wanted $75,000 from the government for his invention.

## THE TELEPHONE.

**St. Louis, Mo.**—The Brown Telephone Company, a new organization, has applied for permission to put up poles along St. Louis streets. The Board of Public Improvements has the matter under consideration.

**Massachusetts Legislation.**—The mercantile committee of the Massachusetts Legislature has voted unanimously against regulating telephone rates, and has voted 7 to 4 against limiting the percentage of stock which the Bell company can hold in other corporations, such as its sub-companies. The committee will report a bill on the subject of underground wires.

**Put Him on the List.**—A resident of Burlington recalls the fact that about 30 years ago a boy named Orville Burbank, who was considered a visionary fellow, had a string running between his father's house and shop in that city, with tin boxes attached at either end, and so arranged that conversation could be easily carried on by the contrivance. "The boy died soon after, but thus he undoubtedly had solved, in a rude manner, the problem of the telephone."

**Mr. Butterworth Indignant.**—Representative Butterworth was asked, on his return to Washington last week, about the insinuations made against his decision as commissioner of patents in the McDonough telephone interference case by the representatives of that company during his absence in Cincinnati. He said that any statement intimating or insinuating that that decision, or any other decision made by him as commissioner of patents, was brought about by improper influences, or was in any other respect anything else than the honest expression of his honest judgment on the merits of the case, was absolutely unfounded in fact. He had never in his public career, he said, done or said anything which would compel him to forfeit his self-respect, and he had never done anything that would not stand examination in the full light of day.

**New England Earnings.**—A careful estimate of the recent losses to the New England Telephone Company by sleet storms the past winter, based upon actual figures for January and February and estimating March, will not exceed $15,000. An estimate made at the time of the storms was from $20,000 to $25,000. Had they been either of these figures, the dividend for the present quarter would not have been earned, as stated some weeks ago in these columns. It is now apparent that the company will earn for the quarter ending March 31 from $58,000 to $60,000, and a dividend of ¾ of 1 per cent. on the seven million block would be $52,500. It is expected the dividend will be declared some time in April. Based upon the quarter ending March 31 (exclusive of sleet storm losses), the earnings for the quarter ending June 20 will be $75,000, or at the rate of 4.28 per cent. on the issued seven million block; or, taking the present market price of the stock at 31, multiplied by 70,000 shares, $2,170,000, the earnings would be over 13 per cent.

**The Patent Suit.**—President Cleveland is said to have already been seen several times in the interest of applicants for the judgeship rendered vacant by Judge Baxter's death, but has not indicated to any one what course he will pursue in the matter. The telephone suit is of such a character and involves such consequences that very few men would be willing to accept an appointment loaded with the responsibility of trying it, and probably President Cleveland would prefer to be relieved of the duty of selecting and appointing a man to try that suit by having it transferred from the court where the bill has been filed to the court of some judge who was appointed before the suit was thought of. For these reasons it is likely that a successor to Judge Baxter will be appointed with as little unnecessary delay as possible and the telephone suit transferred to another locality. In any event, it has been determined that the case will be tried by a circuit judge and a district judge at the June term.

## THE ELECTRIC LIGHT.

**Batavia, N. Y.**, is contemplating the expenditure of $12,000 on an electric light plant.

**Manchester, N. H.**—It is said that the station at the above place will cost about $30,000.

**Fashion's Haunt.**—The Saratoga Gas Company will light Saratoga Springs, N. Y., by electricity next June.

**Dundee, Va.**—The Richmond and Danville railroad authorities propose to use some arc lights at Dundee, Va.

**Albert Lea, Minn.**—The City Council of Albert Lea, Minn., favors the electric light, and is about to select a system.

**Millville, N. J.**—It is proposed to form a company for the purpose of running electric lights at Millville. Mr. R. M. Atwater is one of the gentlemen interested.

**South Bethlehem, Pa.**—An electric light company has been formed to operate at South Bethlehem, Pa. The capital is $10,000. Mr. C. F. Smith, of Bethlehem, is the treasurer.

**Abilene, Kan.**—The Abilene Water and Electric Light Company has been organized with a capital stock of $200,000. J. I. Drake, of Malone, N. Y, is one of the incorporators.

**A Boycott at Reading, Pa.**—At Reading all persons furnishing material to the Reading Electric Light Company and all merchants using its light have been boycotted by the Bricklayers' union, because the company employs non-union men.

**North Attleboro, Mass.**—A Schuyler plant has been started at the above place by Messrs. Daggett & Hancock, who lately introduced a 25-light plant of the same system at Westfield. The new plant is of 45 lights capacity, and the dynamo is run by a Ball engine.

**The Sun System.**—The Sun Electric Light Company, of Woburn, Mass., advertises in this issue its high-tension distributing system, which has already been successfully tested in several leading electric light plants, and, it claims, found safe, economical and flexible in use.

**Carbon Consumption.**—A very good evidence of the activity in arc lighting is given by the consumption of carbons. The Brush Electric Company sold more carbons last month than ever before, and this was not an exceptional output, but the highest point reached by figures steadily increasing all the time.

**Pittsburgh, Pa.**—The Allegheny County Light Company, Pittsburgh, Pa., within a month expect to begin the erection of a 5-story building, 96x90 feet, of brick and fireproof. Cost in the neighborhood of $60,000. The upper stories will be used for light manufacturing purposes, the company furnishing light, heat and power to the parties renting. They will also erect a station on South Diamond street, Allegheny, which will cost about $5,000. It will have about one thousand incandescent lights and one hundred arc lights.

**Safe, Cool, Controllable.**—Mr. M. S. Greenough, of the Boston Gas Light Company, in his address as President of the New England Association of Gas Engineers, at the last meeting held at Providence, R. I., said that local gas companies should give attention to the question of adding electric lighting to their present business. He admitted the superiority of electricity in hot weather, which, on account of its safety, coolness and entire control, is more desirable than gas, but he considered that in winter the latter had the advantage.

**Western Activity.**—Chicago is moving slowly in the matter of public electric lighting, but private enterprise is pushing this light into use, and in many parts of the city, notably in business centres, our streets and stores at night are in "a blaze of glory." The lights in the dingy old Government building and those in the city hall are about all the public electric lights in use, save in one of the tunnels, on the Rush street bridge, and on the lofty tower of the new Board of Trade building. All over the West, cities of smaller growth, and even towns and villages, have adopted the electric light in some form or another. There is not a week passes that the electric light manufacturing companies of this city are not sending out and erecting new plants at various localities in the West and Northwest.—*Western Manufacturer.*

## APPLICATIONS OF POWER.

**Montgomery, Ala.**—The Van Depoele electric cars of the Capital City Street Railroad Co., of Montgomery, Ala., have been satisfactorily put into operation.

## PERSONALS.

**Recent Changes.**—Mr. J. H. Reid, formerly with the United States Electric Lighting Company, has joined the New York Insulated Wire Company. Mr. Fred Angell will hereafter devote his time exclusively to the interests of Day's Kerite. Mr. C. A. Rolfe, lately with the Western Electric Company, will represent the Gamewell fire alarm.

**Mr. E. V. Cherry**, of the Standard Electrical Works, Cincinnati has been elected an alderman for the first district of that city. His simple platform is honest government and low taxes, and his many friends know how energetically he will carve a good record out of those two planks. Cincinnati is to be envied such public officials. Capt. Stone, by the way, ceases to be a city father, retiring after 8 years of faithful service, with the esteem of all.

**William J. Denver**, assistant general manager of the New England Telephone Company, by a change in the method of management, will hereafter make his headquarters in Springfield. He has been in Boston since September, 1885, but from the first of this month will have charge of the western division of the company's business, which begins at South Framingham, and includes Western Massachusetts, Southern Vermont and Southern New Hampshire.

**Prof. A. G. Bell.**—A recent newspaper letter from Washington gives a long and interesting account of Prof. Bell and his work. One passage says: "The education of the deaf is one of his hobbies, and he has spent a great deal of money upon it. He had for a time a deaf and dumb school here, where, at his own expense, he taught a number of little deaf and dumb children. Some of these children are being taught under his directions yet, though the main branch of the school has been discontinued." It is also stated that Prof. Bell is about to remove his electrical workshop and laboratory to Georgetown, on the outskirts of the capital.

## MISCELLANEOUS NOTES.

**Electric Time.**—Mr. Hussey, Western Union manager at Menlo Park, is credited with the invention of an electric clock.

**Looping in the Armories.**—The armories in Philadelphia are to be put on the city's telegraph and telephone circuits.

**A Battery Company.**—The Little Giant Battery Supply Company, of Portland, Me., is announced, with a capital of $100,000. President, Mr. Samuel T. Holmes.

**Train Signals.**—The Victor Electric Train Signal Company, of Portland, Me., has a capital stock of $300,000. Its president is Mr. George D. Hanlon, of Cambridge, Mass.

**A Portrait of Morse.**—Phillips Academy was recently presented with a portrait of Prof. S. F. B. Morse, painted by Thomas Hicks, National Academy, which shows the medals he received for his perfection of the telegraph.

**For Her Majesty's Arsenal.**—A number of Armington & Sims engines have recently been ordered for the Royal Arsenal at Woolwich, by the British Government, from Messrs. Greenwood & Batley, who represent the Armington & Sims Company in England.

**A New Departure.**—Frenyear & Razee, the electrical manufacturers of Boston and Exeter, N. H., have become agents for the "Exeter" double steam engine, the peculiar feature of which is that it has two cylinders on one bed, running a single shaft and fly-wheel. The firm think that the device meets the problem of reserve engine power in lighting plants, and will give special attention to this new branch of business.

**Longfellow on Lightning.**—In the life of Longfellow, just issued, the following happy little passage is quoted from his diary: "Lightning is a ferocious visitor when it comes to a man's house, bursting in so unceremoniously, yet ringing all the bells to announce his presence, and away again after shaking hands with the inmates and dancing wildly on the bell-wires. A kind of Robin Goodfellow with his ho! ho! ho!"

**Another Application of Electricity.**—Mr. W. Thomson, F. R. S., uses electricity as an adjunct in a method of determining the relative degrees of stiffness of flour or of starch, pastes, or jelly. The method he proposes (after making many experiments) was to allow a spindle of iron 10 in. long to fall a distance of 12 in. into the paste, and then to measure with a rule the distance to which the spindle penetrated the paste. The spindle was supported by being attached to an electro-magnet, and when it hung from the magnet quite steadily the current of electricity was broken, the magnet lost its magnetism, and the spindle fell. By this means exactly the same momentum can be given to the spindle on its arrival at the surface of the paste: and, considering the nature of starch pastes, the results obtained were satisfactory.

**Electro-Chemistry.**—A recent issue of the *Comptes Rendus* contains an interesting note upon the electrolysis of salts, relating principally to galvanoplasty. The experiments of M. Renard are borne out in several important points. In known solutions it is believed that the quantity of metal precipitated is proportional to the temperature. This proportion, however, would appear to increase in the inverse ratio to the density of the liquid. When the distance of the electrodes is successively doubled, the quantity of metal precipitated decreases in geometrical progression so long as the distance is less than 32 centimetres. Above this value the law is not applicable. When the two electrodes are identical the quantities of metal precipitated are proportional to the square root of their surfaces.

**Regulating Room Temperature.**—A novel device for controlling the temperature of rooms heated by natural gas has lately been made by Mr. Westinghouse and has been patented. It consists of a brass tube filled with alcohol, fastened to the wall of the room. This tube connects with the gas-pipe leading to the grate, where it is attached to an automatic valve. Attached to the tube of alcohol is a check-cock arrangement which can be set at any desired temperature. If the temperature rises above this, the alcohol thermometer records the fact and communicates it by an electric wire to the valve which is closed. As soon as the temperature commences to fall below the desired degree, the valve is opened by the same method. Should the weather grow warmer, the instrument gradually shuts off the gas sufficiently to maintain the proper temperature.

**Prof. Henry's Big Magnet and Battery.**—Among the many valuable and historic pieces of apparatus about the college are several instruments which were invented and used by the late Professor Henry in his experiments on electricity. In one of the laboratories of the school of science may be found his "big magnet," as it is called, mounted on a large frame, which, when charged with electricity by means of his "big battery" of one cell, was capable of lifting 3,300 pounds. He afterward made one of nearly the same size and capacity for Yale, which has been in constant use there until within a few years, when it was laid aside, and is now preserved among other relics of the college. Professor Henry's large magnetic globe, made partly of wood, constructed so as to show the electric current of the earth and the dipping of the needle, together with his galvanometers, coils, electro-magnets, and recorders, are of special interest and of peculiar historical value.—*Princetonian.*

**Combustion of Copper and Nitrogen.**—A curious phenomenon has been observed by M. Blondlot, and communicated to the French Academy of Sciences. A disc of platinum and a disc of copper, 0.03 meter in diameter, were fixed vertically in front of each other by help of two platinum stands. The discs were 3 or 4 millimetres apart, and both were placed inside a bell jar of porcelain, open below. The apparatus was then heated red hot for three hours, by means of a gas furnace, and although there was no electric current it was found that the face of the platinum disc was blackened with a deposit containing copper and platinum. In short, the copper had crossed from the copper plate to the platinum one. M. Blondlot, by repeating the experiment in different gas, found that the nitrogen of the air was the agent in this transport of matter. The nitrogen combines with the copper, and lodges on the platinum, either incorporating itself with the latter or decomposing in contact with it under the influence of high temperature.

**A True Polar Meridian.**—At the March meeting of the Southern Society of Civil Engineers, a paper was read by Mr. J. F. LeBaron, on "The Desirability of the Establishment of a True Polar Meridian and Standard of Length in Each County of the State." This paper provoked considerable discussion, and it was voted that it be printed, and that copies of the paper be sent to all the vice-presidents of the society in the several States, with a request that a petition be drawn up and presented to the Legislatures of the respective States, asking that two polar meridians and standards of length be established in or near the shire towns of each county in their State, these

petitions to be drawn in the name of the society, and further, that the matter be brought to the attention of the governors of the respective States, and that they be asked to embody it in their annual messages, to the end that such meridians and standards may be established and a law be enacted requiring every surveyor practicing in that county to annually test his magnetic needle and chain or tape measure by this meridian and standard, and record the result in the office of the county clerk, under penalty of a suitable fine for non-compliance.

## STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

**Telegraph.**—B. & M., b 2, a 3; Western Union, b 66¼, a 66¾.

**Telephone.**—Am. Bell, b 162, a 162½; Erie, b 27, a 27½; New England, b 34, a 35.

**Electric Light.**—No new quotations.

## SPARKS AND FLASHES.

**How to Get Up a Strike.**—A man who will yet make a great name for himself is the telegraph editor of the Buffalo *Express*. If Mark Twain had not long ago given up his chair in that office, people might think he was the t. e. of that interesting daily. The Buffalo man is greater than the Knights of Labor and the Executive of the United States rolled into one. He inaugurated a great strike in Michigan and then called out the troops and killed twenty men. He did it all with his little pencil. Staring head-lines announced these appalling particulars. The t. e. thought that the Belgian town of Charleroi was the Michigan village of Charlevoix, and so flung his head-lines to the breeze and startled all Buffalo.—*Detroit Free Press.*


## BUSINESS NOTICES.

**Pike's Toothache Drops.**

Cure in 1 minute; harmless, quick, thorough; no equal; 25c.

Dean's Rheumatic Pills are a prompt, sure cure; 50c.

Hale's Honey, the great cough cure, 25c., 50c. and $1.

Glenn's Sulphur Soap heals and beautifies the skin; 25c.

German Corn Remover kills corns and bunions, 25c.

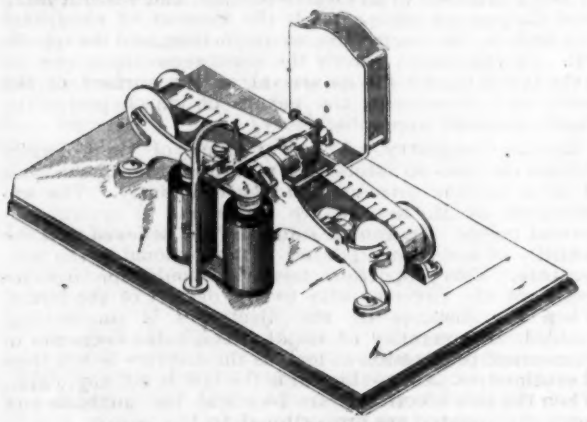
Hill's Hair and Whisker Dye, black and brown; 50c.


# OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

### PATENTS DATED MARCH 30, 1886.

**338,691. Telegraphy**; George W. Baldrige, St. Louis, Mo. Consists of a disc carrying letters, figures, or characters, and having a way behind the letters, figures, or characters, and an arm carrying a contact-brush and a pin or projection, the parts being so arranged that the pin or projection will traverse said way while the contact-brush is bearing against the letters, figures, or characters.

**(1) 338,692, (2) 338,910. Dynamo**; Royal E. Ball, New York, N. Y. (1) The details of construction are shown in the cut. (2) Embraces cores of field-magnets, composed of forged iron end frames having hard-metal bearings attached thereto for the reception of the armature shaft.



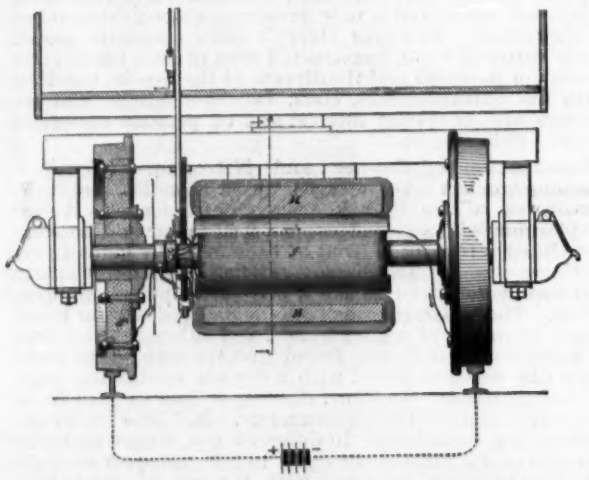
339,092. Electric Time Recorder.

**338,697. Electric Call-Bell System**; James L. Beers, New York, N. Y. Provision is made, together with the ordinary call-bell and annunciator-circuits, for automatically sounding a call at a predetermined time at the hotel office, and also, if desired, at a particularly designated distant point.

**338,708. Artificial Electric Resistance**; Harold P. Brown and Francis H. Brown, Chicago, Ill. Thin plates of metal are superposed and provided with a pressure regulator.

**338,733. Covered or Insulated Wire**; William M. Habirshaw, New York, N. Y. Consists in winding a plastic vulcanizable strip of substantial thickness spirally about the wire, with its edges abutting, and causing said abutting edges to adhere about the wire.

**(1) 338,747, (2) 338,748. Electric Gas Lighter**; Charles W. Holtzer, Brookline, Mass. (1) The direct construction is shown in the cut. (2) Consists of the burner-tube and oscillating circuit-closer pivoted thereon, with a fitting at the base of the tube containing a cock and having its spindle provided with a ratchet and a pawl and pawl-carrying arm loose on the said spindle and connected with the circuit-closer, and a spring to restore the arm to its normal position.



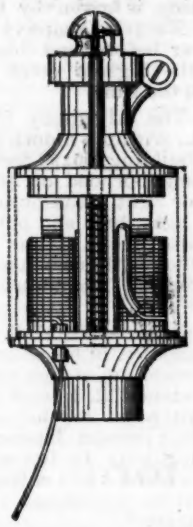
339,073. Electrically Actuated Locomotive.

**338,752. Automatic Safety Circuit Controller**; Oscar F. Jönsson, Stockholm, Sweden. Consists of improvements upon the solenoid cut-out.

**338,757. Telegraph Transmitter**; Godfrey H. Lasar, St. Louis, Mo. Consists of improvements upon Baldrige's patent, above described.

**338,770. Pocket Battery**; Gustav Otto, Jersey City, N. J. Consists in making the body of a battery entirely of flexible material—such as vulcanized india rubber—which wholly incloses the electrodes and the liquid contents of the battery, and which is sufficiently flexible to expand under the influence of gases generated within it.

**338,773. Electric Clock**; Chester H. Pond, Brooklyn, N. Y. In place of the usual form of crutch applied to the pendulum of a regulator, a weighted arm is employed, this arm being attached to the escapement-anchor in the same manner as the crutch.

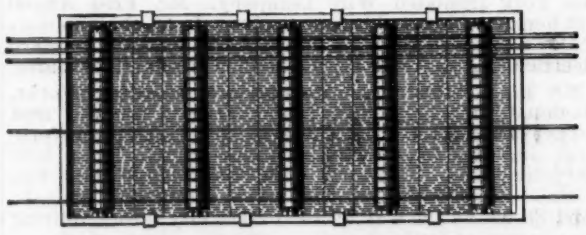


338,747. Electric Gas Lighting Burner.

**(1) 338,889, (2) 339,121. Telephones**; William C. Turnbull, Baltimore, Md. (1) Relates to a telephone switch, and consists of the pivoted supporting-hook and the spring secured thereon in such relation to the end of the hook as to make it necessary to exert an upward and downward strain upon the hook in removing and replacing the telephone (2) Consists of improvements upon Olmsted's pivoted contact bars, shown in patent 252,132, January 10, 1882.

**(1) 338,919, (2) 338,920. Electric Light Pole**; Thomas H. Brady, New Britain, Conn. Relate to a pole having an adjustable projecting piece at the top, and they consist of improvements in the disposition of the pulleys and drums.

**338,927. Railway Signal**; Angel Castor, New York, Assignor of one-half to George A. Saward, Brooklyn, N. Y. Embraces the picking up, by means of a magnet carried by the train, of small discs placed in proper position through the action of electrical devices controlled from a distant point, said discs bearing the information which it is desired to impart to the engineer or conductor of the train.



338,941. Forming Wire by Electrolysis.

**338,935. Electric Alarm Clock**; George H. Davis, Washington, D. C. Embraces a contact wheel provided with metallic blades extending into the path of the hour pointer.

**338,938. Combined Battery and Switch for Telephone Systems**; Charles A. A. F. de St. Aubin, St. Louis, Mo. Consists of a main circuit, an alarm circuit and a rock-shaft, to which one electrode of the battery of the main circuit and the make and break of the alarm circuit are secured in such manner that the making of one circuit breaks the other.

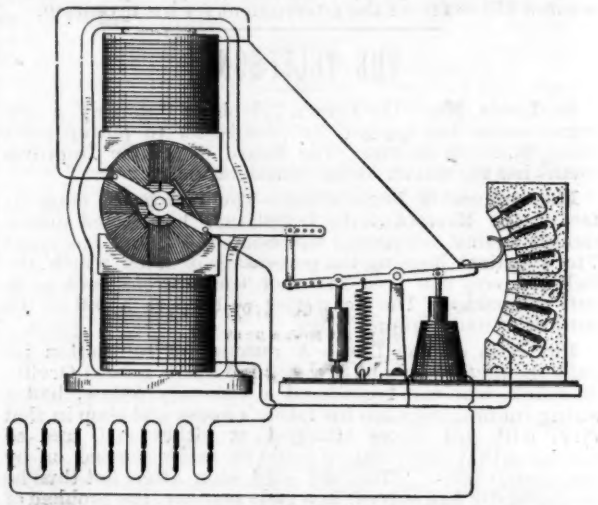
**338,941. Electrolytically Formed Wire**; Moses G. Farmer, New York, N. Y. The wire is passed through a depositing vat as shown in the cut.

**(1) 338,976, (2) 338,977. Electric Motors**; Vincent E. Keegan, Boston, Mass. Embrace improvements upon his patent 275,392, April 10, 1883.

**338,996. Quadruplex Telegraph**; William Maver, Jr., Jersey City, N. J., Assignor to the Baltimore & Ohio Telegraph Co., Baltimore, Md. As it is necessary that the main-line transmitter should not respond to the completions and interruptions of the branch circuit occasioned by the movements of the branch transmitter in response to incoming main-line currents, means are provided for maintaining the circuit of the branch-line battery complete in whatever position this transmitter may be.

**339,017. Magnetic Separator**; Gottlob Schaeffer, Göppingen, Würtemberg, Germany. Consists of the frame of the apparatus provided with discharge openings at its opposite ends, the magnets, a non-magnetic conveying surface applied over the poles of the magnets on a line with said discharge openings, and a reciprocating wiper and reversing devices for automatically reversing the traversing motion of the wiper.

**339,018. Electric Railways**; William M. Schlesinger, Philadelphia, Pa. Consists of a line-circuit having sections, each of which is provided with a safety device, a



339,079. Regulator for Dynamo Electric Machines.

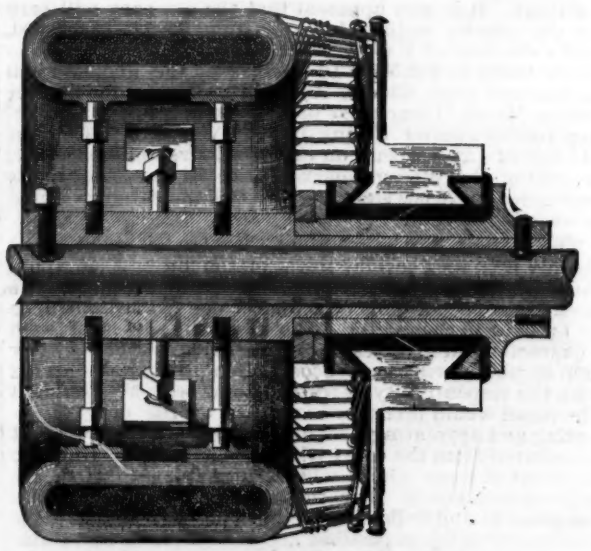
feeding conductor or conductors for the safety devices, an indicator-box, and circuit connections between the safety-devices and the indicator-box.

**339,043. Electric Horse Unhitcher**; Andrew J. Coffee, Portland, Oregon. It is for releasing horses at a fire-engine house, and consists of a lever adapted to be released by the electric fire-bell circuit.

**339,058. Electrical Indicator**; John W. Howell, New Brunswick, N. J., Assignor to the Edison Lamp Co., Harrison, N. Y. Consists of an improvement upon Bradley's patent 280,563, July 3, 1883.

**339,073. Electric Locomotive**; Frank L. Pope, Elizabeth, N. J. The field magnet rotates within the armature while the armature is fixed to the car frame. See illustration.

**339,079. Dynamo Regulator**; Elihu Thomson and E. Wilbur Rice, Lynn., Mass., Assignors to the Thomson-Houston Electric Company of Connecticut. Consists, broadly, in the combination of means for varying the



338,692. Dynamo Electric Machine.

strength of the magnetic field in which the armature revolves, and means for operating simultaneously to adjust the commutator. See illustration.

**339,092. Electric Time Recorder**; Albert C. Frieske, Jacksonville, Fla. As shown in the cut, it consists in combining with a paper fillet a clock-movement to regulate its feed, an electro-magnet to actuate an armature carrying a stylus, and a circuit-changer.

**339,094. Circuit-Closing Attachment for Pressure Gauges**; Milton W. Grovensteen, New York, N. Y. He combines two insulated contact arms with the ordinary gauge.